Wonders of Transport

CYRIL HALL

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"Wood and What We Make of It" &c.

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Prefatory Note

Transport is the alpha and the omega of civilization. Yet in itself it has had no beginning, and can never end until mankind is burnt or frozen off the earth. How in its growth from childhood to adolescence it has altered the destiny of nations—is still changing, as it must ever change, the fortunes of a war in which are many rivals—the following pages do not profess to show. This book is not a history of transport, but a collection of episodes in that history, wonders which may stimulate to a deeper study of a vital aspect of our welfare. For the benefit of those who are tempted to dig farther into these wonders the author diffidently suggests that the following books will provide food for thought and at the same time entertainment and excitement. There is no one book which covers the whole subject, and if there were it would be hopeless and helpless in its ponderousness. For a beginning, then, let the reader take up *Tillage, Trade, and Invention*, by Townsend Warner (Blackie & Son, Ltd.), which, while it does not deal specially with transport, is an able and very readable study of the causes that have led to successive stages in the development of the machinery of transport. Follow this up with *A History of Inland*

Transport and Communication in England, by E. A. Pratt (Kegan Paul, Trench, Trübner & Co., Ltd.). For the story of the rise of merchant shipping and the adventures of those who traced the ocean routes, *Master Mariners*, by J. A. Spears, a little book in the Home University Library (Williams & Norgate), may be confidently recommended; while Mahan's *Sea Power* is a valuable work, which may be consulted in any public library. It is unnecessary to suggest titles of books dealing with modern railways, steamers, motor cars, aeroplanes, and the miscellanea of twentieth-century invention.

A final word in the ears of those readers of this book who think they have left school. Keep one book by the side of the dictionary on your table, and let it be a good up-to-date comparative geography.

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HOW TEA IS CARRIED IN THE INTERIOR OF CHINA

The leaf of the tea plant passes through many strange journeys before it finds its way to the teapot. The best China tea never leaves China, but is drunk by the mandarins. The second quality goes to Russia, while only relatively inferior sorts are exported to the rest of the world.

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WONDERS OF TRANSPORT

CHAPTER I

Introductory

HAVE you ever considered the subject of commerce in its practical bearings upon your own daily life? Have you ever tried to form an idea of the immensity of the organization which has been created to supply your particular wants? If so, you could hardly fail to realize the fact that the greatest industrial undertaking in the world—the industry upon which all other industries depend—is the carrying trade, the trade which brings to the craftsman and the manufacturer the raw materials for their work, and delivers the finished product into the hand of the individual who happens to want it. Every hour of the day and night, steamships are furrowing the ocean; trains are rushing along the railway; men and women, horses, oxen, mules, camels, elephants, and even dogs are toiling in one part of the globe or another to anticipate your needs. In your pocket,

if you are a lucky fellow, is Aladdin's lamp. In this unromantic age it is called currency; but it is the same thing, with the difference that nowadays it can accomplish marvels of which Aladdin never dreamt. Place the magic lamp on the counter of the city store or village shop, and what wonders will it not perform! Would you like an apple from British Columbia, a banana from the West Indies, or chocolate from Brazil? You have but to name it, and hey, presto! the apple, the banana, or the chocolate is in your hand. For a small piece of copper the modern Genie of the Lamp will take a letter from you to the Antipodes, or will carry you bodily for a mile with greater speed and comfort than the Sultan Haroun al-Raschid ever travelled with in his life. Nor are the powers of the Genie limited to the surface of earth and ocean. Say the word, and he will bring you with equal ease a graphite pencil from the mines of Cumberland, or a sponge from the depths of tropic seas. In winter the house must be warmed and brightened. There are no flowers in our island gardens then, but your mother says "Narcissi", and the graceful blooms, gathered the day before in France or Scilly, are on the dining-room table. Your father shivers, and, ringing the telephone bell, says "Five tons of Silkstone, as before". In an hour or two there is thunder in the cellar, and you know that the Genie of the Lamp has brought the coals.

The name of the Genie is Transport. In the following pages we will try to trace his growth from a puny child wandering in the trail of a savage tribe

to the colossal giant which now bestrides two hemispheres and distributes the world's products in a ceaseless and intelligently directed shower.

You have heard, I dare say, of a famous chapter on Snakes in Ireland, which consisted of the six words: "There are no snakes in Ireland". A chapter on Transport in the Earliest Age of Man would be almost equally brief. Obviously there can be no transport unless there is something to carry; and it must have been thousands of years after man first walked the earth when he learnt to carry things from one place to another with any more intelligent idea of turning them to account than is shown by a dog in running off with a bone, or a bird in gathering materials for its nest. Even when necessity taught him to make weapons for self-defence and for obtaining food, and to collect things such as skins and shells for his comfort and decoration—in other words, when he began to acquire portable property—he could keep no more than he could carry and defend with his own strong arm. By and by he discovered the disadvantage of a condition of affairs in which every man was a law unto himself, and he combined with his fellow savages to enforce a certain amount of respect for ownership. Tribal customs and regulations grew up which provided more or less security for property, and negotiations began to supersede robbery as the rule of exchange. Men began to accumulate goods—rude weapons for fighting, hunting, and fishing, skins for covering themselves in cold weather, shells for use as drinking vessels, and charms warranted to defeat the designs

of evil spirits. Then bartering became a business wherever there was anybody to barter with; and then, as men wandered from one hunting-ground to another, the question of transport first began to exercise their ingenuity.

For ages the intelligent but costly animal which is sometimes facetiously called "Shanks's Pony" must have been the chief means of transport employed; and this not so much on account of the difficulty of capturing and taming wild animals, as because the trackless world in which our remotest ancestors lived was for the most part unadapted for quadrupedal traffic. Porterage is still the principal means of carriage in certain countries of the globe—for example, in the jungles of Darkest Africa and the mountainous districts of Northern India; and men and women, trained to the task, can carry burdens of surprising weight upon their heads or backs for a long day's march. In other countries where roads are too bad for easy travelling on wheels, man-carriage is preferred by the luxurious. Sir Francis Head, in his *Rapid Journeys across the Pampas and over the Andes*, published many years ago, described and pictured a curious mode of transporting travellers over the Andes. The picture shows a middle-aged gentleman in European dress, which includes a high collar and a chimney-pot hat, riding on the back of a nearly naked Indian. The traveller's heels are supported by a sling which passes over the head and shoulders of his bearer, whose hair he grasps with both hands. He does not look particularly confident or comfortable, and I think that if I were in his place

I would prefer to get down and walk. Much more comfortable modes of man-conveyance which still survive are the palanquin and dandy of India and the rickshaw of Japan. In this connection I may remind you that less than a hundred years ago the sedan chair, the western representative of the palanquin, was to be seen in the streets of many English towns. On the railings of a few old houses in the West End of London you may still see the iron extinguishers in which the link-boys put out their torches after they had escorted my lady's chair home from rout or opera. If you know your *Pickwick* you will remember that Mr. Pickwick and Mr. Tupman, when arrested at Ipswich, were carried to the Mayor's house in "an old sedan chair, originally built for a gouty gentleman with funded property", and capable, therefore, of carrying two persons of ordinary size. You will remember also, I dare say, that on the night of the Assembly which Mr. Pickwick attended at Bath, poor Miss Bolo went home "in a flood of tears and a sedan chair".

At what period in the world's history four-footed animals were first enslaved by man, or what was the first animal so tamed, we have no means of ascertaining with certainty. Archæologists divide the traces of men and animals which have been found in caves into three periods, but opinions differ widely as to the ages of these periods as measured by years. In the first, or Pleistocene period, we find the remains of man in company with those of the mammoth, the sloth, and the woolly rhinoceros, as well as of other animals, such as the horse, lion, wolf, fox, bison,

stag, and hyena, whose representatives are still with us. The cave-dweller of the Pleistocene period was akin to the modern Eskimo. He had discovered how to make a fire; probably he cooked his food. He made rude implements of flint and bone; he covered himself with skins sewn together with sinews or strips of intestines; and he spent some of his idle hours in engraving, upon horn and ivory, representations of the animals with which he was familiar. "Those drawings", says Professor Boyd Dawkins, "are full of artistic feeling, and are evidently drawn from life. The mammoth is engraved in its own ivory, the reindeer and the stag on their respective antlers." But those ancient artists possessed no domestic animals. The second period of man's development is called the Prehistoric, and comprises what are called the Neolithic, Bronze, and Iron stages of civilization. It is in the relics of this period, which immediately precedes the Historic, that evidences of the domestication of animals are first found. The bones of the dog and the ox are among them; and it is reasonable to suppose that these two animals, originally kept for food, were the first to be commonly employed for transport. The wheel had not yet been invented, but a sledge of some sort would be well within the mechanical capacities of Prehistoric Man. Probably he made a sledge before he had a tame dog or ox to draw it, but, given the possession of so useful a servant, the bright idea of putting it into harness would very soon occur to him.

CHAPTER II

Animal Transport

THE domestic dog of to-day is probably the product of the crossing of several species of wild animals, living and extinct. As a transport animal he is not now of much account except in Polar regions, but there he is all-important both to the native dweller and to the explorer. The famous dogs of the Far North are known by the names of the peoples who have bred them.

The Eskimo dog is usually of a black and white colour, nearly as large as a mastiff, with a bushy tail and a black pointed muzzle. He is sometimes employed as a beast of burden, carrying loads on his back, but more often in drawing sledges over the snow. On a good surface, half a dozen dogs will, it is said, draw a load of 8 or 10 hundredweight at the rate of 7 miles an hour. Kane, the Arctic traveller, relates that six dogs carried him, with a well-loaded sledge, for a fortnight at an average rate of nearly 60 miles a day. Such useful servants deserve good treatment; but "I never heard", says Kane, "a kind accent from the Eskimo to his dog. The driver's whip of walrus hide, some 20 feet long, or a stone or a lump of ice skilfully directed, an

imprecation loud and sharp made emphatic by the fist or foot, and a grudged ration of seals' meat, make up the winter's entertainment of an Eskimo team." "Neither the dog nor his master", says Captain Parry in his *Journal*, "is half civilized or subdued"; and it is scarcely to be wondered at that the poor beasts are irritable and difficult to manage. A trustworthy and experienced dog is chosen as leader of the sledging team, and, as there are no reins, is guided solely by the driver's voice and the crack of his whip. The actual stroke of the whip is used, when driving, as little as possible; not, I am afraid, from any motive of kindness to animals, but because, if a dog feels the lash, he is as likely as not to turn round and attack the dog behind him, throwing the whole team into confusion and perhaps upsetting the sledge.

The dogs of the Samoyedes of northern Siberia are very much like those of the Eskimos, and equally perverse. Mr. Bernacchi, who accompanied the Antarctic expedition of 1898–1900, gives an amusing account of the way in which these dogs would make the smallest obstruction an excuse for stopping. "Directly a hummock was encountered, the dogs, with their usual instinct, immediately squatted on their haunches, looked perfectly enchanted at the occurrence, and regarded us complacently as we came up to give the sledge a start. I had no patience with them, and struck them with my heavy fur gloves; this, however, proved more detrimental to the gloves than to the dogs, and tended to make confusion worse confounded, for as you aimed at them they leapt over

one another to get out of the way, and tangled up their harness in a bewildering mess, and you would have to pull off your mits, and, at the risk of frozen fingers, disentangle it. Even when you did succeed in chastising one and disburdening yourself of some wrath, the tantalizing beast would avenge the blow by giving a vicious bite to his neighbour, who immediately passed it on to the next; and thus the biting and quarrelling would pass from one to the other along the line until the whole team became a heap of pugnacity. The amount of cunning and perversity they displayed was simply astonishing." The Kamchatka dogs, which are also used for sledging, are said by some authorities to be even swifter and more enduring than those of the Samoyedes and Eskimos. In summer they run at large and cater for themselves, but as soon as the snow reappears they return to their masters, preferring regular meals, even though accompanied by kicks and hard work, to freedom and semi-starvation.

Except on snow-covered ground the dog is unfitted for draught purposes by reason of the softness of his paws. Nevertheless, before the existence of societies for the prevention of cruelty, the dog in harness was once a common object in the streets of English towns. Thus in a description of Bristol at the close of the seventeenth century we read that "if a coach or cart entered the alleys there was danger that it would be wedged between the houses, and danger also that it would break in the cellars. Goods were therefore conveyed about the town almost exclusively in trucks drawn by dogs." In some Continental countries

dogs may still be seen drawing small carts laden with vegetables, laundry linen, or dairy produce; and in Newfoundland the famous dog which takes its name from that island is used by the peasantry for drawing fuel from the forest. I may add that although the dog is frequently pictured upon Egyptian monuments four or five thousand years old, there is no evidence of its use as a draught animal in the ancient civilizations of Europe and Asia. The Egyptians regarded it as sacred, and, perhaps for that reason, the Israelites held it to be unclean. Apart, moreover, from these considerations of religion, there could have been little or no inducement to harness the dog when there were other animals in every way better fitted to perform the labours of transport.

An animal which like the dog is of great service as a carrier in snow-clad countries is the reindeer, which has long been domesticated in Scandinavia, and which is to the Laplanders what the horse, sheep, ox, and goat are to the dwellers in milder climes. A humane law forbids the Lap to put a heavier load than 130 pounds upon the reindeer's back, or to make it draw more than 190 pounds upon a sledge, but these weights it can carry or draw for ten or twelve hours at a time, at the rate of about 10 miles an hour. The worst enemy of the reindeer is a sort of gadfly which lays its eggs in his hide and torments the poor animal cruelly. This persecution is partly the cause of the reindeer's habit of leaving the lowlands every year. It would be odd if all the cows or the sheep in England, when summer came, kicked up their heels and trotted off to the seaside for a change of air; but

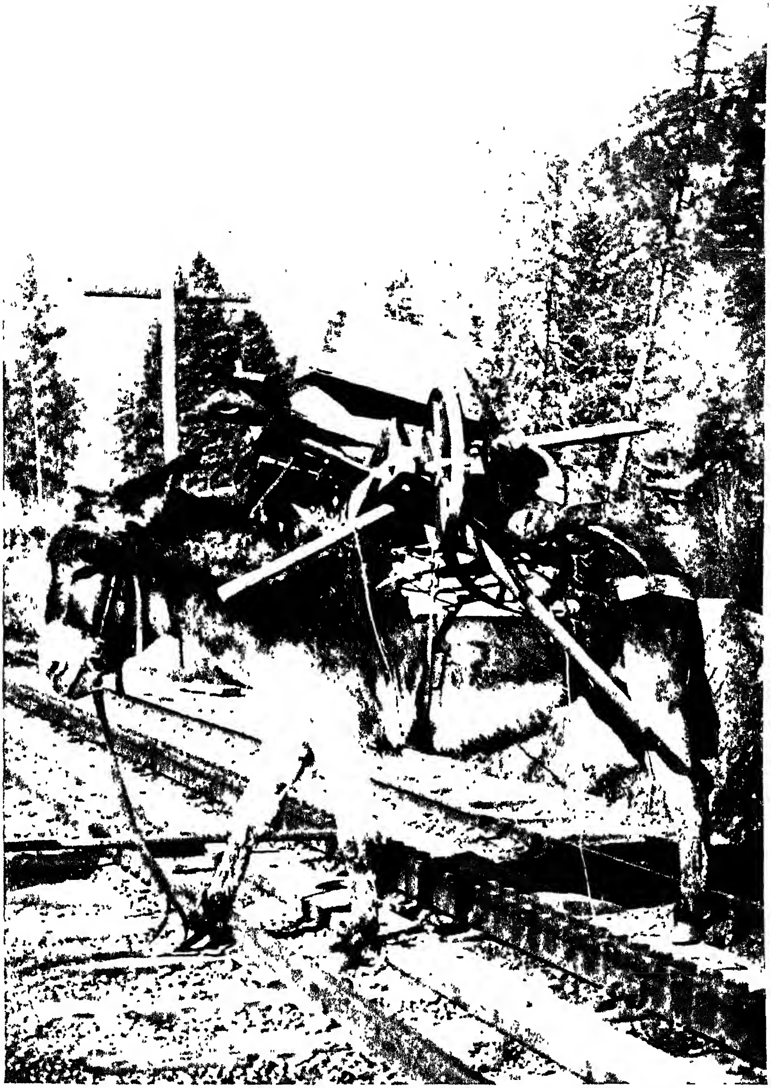
that is what the Laplander's cattle do, and the Laplander and his family have to go with them.

The animal which perhaps contributed more than any other to the growth of early civilization was the ox. "It is impossible", wrote Mr. John Gibson, a well-known authority on cattle, "to over-estimate the services rendered by the ox to the human race. Living, it ploughs its owner's land and reaps his harvest, carries his goods or himself, guards his property, and even fights his battles, while its udders, which under domestication have been enormously enlarged, yield him at all seasons a copious supply of milk. When dead, its flesh forms a chief source of animal food; its bones are ground into manure or turned into numerous articles of use or ornament; its skin is made into leather, its ears and hoofs into glue; its hair is mixed with mortar; and its horns are cut and moulded into spoons and other useful articles."

We have evidence of the use of oxen for transport from the earliest historic times. In the monuments of ancient Assyria and Egypt there are many sculptured representations of oxen drawing carts laden with captives or produce. The Biblical references, both to oxen ploughing and to oxen harnessed to carts, are frequent. "And they brought their offering before the Lord, six covered waggons, and twelve oxen; a waggon for two of the princes, and for each one an ox" (*Numbers*, vii. 3). "And the men . . . took two milch kine, and tied them to the cart, and shut up their calves at home: And they laid the ark of the Lord upon the cart. . . . And the kine

took the straight way to the way of Beth-shemesh, and went along the highway, lowing as they went" (1 *Samuel*, vi. 10–12). We read of them also as beasts of burden: "Moreover, they that were nigh them . . . brought bread on asses and on camels and on mules and on oxen" (1 *Chronicles*, xii. 40). In many countries the ox is still used for transport. In some parts of India, of Southern Europe, and of South America the slowly moving cart drawn by a pair of oxen is one of the most familiar objects of the highway; while in South Africa the bullock wagon, drawn by a team of perhaps a dozen horned beasts, is the ordinary means of transporting heavy goods in districts which the railways have not yet reached.

Of next importance to the ox as a bearer of man's burdens in the early days of civilization we must surely place the ass. "Thou shalt not covet thy neighbour's house," says the Tenth Commandment, "nor . . . his ox, nor his ass, nor anything that is his." The mention of these two animals is an indication of the prominent part they played in the life and business of the wandering tribes of the ancient East. The origin of the ass, like that of the dog, is lost in the mists of time. "Man", says the Rev. J. G. Wood, "has so long held the domestic ass under his control that its original progenitors have entirely disappeared from the face of the earth." It is true that wild asses are to be found in various lands, but there is reason to believe that these are the descendants of domesticated animals which have escaped from captivity. Two peculiarities of the patient and surefooted *Asinus vulgaris* seem to indicate that his



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"I HELPED TO BUILD PIKE'S PEAK RAILWAY MYSELF"

The Pike's Peak Railway is a line 9 miles long which climbs to the summit of a mountain over 14,000 feet high, near Colorado Springs. The railway is on the rack system, and carries thousands of tourists every year. It is one of the "sights" of the Colorado Rockies.

forefathers belonged to the deserts of Asia or Africa: one is the surprise and distrust which he evinces, in common with the camel, in finding a stream of water in his path; the other is the delight he takes in rolling in the dust. The Hebrews used him as a beast of burden, for ploughing, and for riding, and held him in high esteem, although as food he was unclean because he did not chew the cud (*Leviticus*, xi. 26). The Greeks, the Romans, the Egyptians, and other nations laughed in their proverbs at his supposed stupidity, but made free use of his services nevertheless.

The bad name has stuck to the poor donkey, but he is really one of the cleverest of domesticated animals. It is said that in Spain, where more attention is paid to breeding than is the case in Northern Europe, as much as £200 is sometimes paid for an ass. The Arabs and Persians, too, give this animal the attention it deserves, and by careful breeding have greatly improved its appearance and usefulness. Darwin found in Syria four distinct breeds—"a light and graceful animal with agreeable gait, used by ladies, an Arab breed reserved exclusively for the saddle, a stouter animal used for ploughing and various purposes, and the large Damascus breed with peculiarly long body and ears". In view of the antiquity of the ass, it is rather surprising to find that, although there is evidence of its presence in Britain in the Saxon period, it was not common in these islands until after the time of Queen Elizabeth.

Even more valuable than the ass as an aid to transport is his half-brother the mule—the offspring of a

to be seen at work in almost every part of the world, and in some countries it is the principal means of transport. Thirty or forty years ago, before tram-cars were driven by mechanical power, mules were often used upon the tramways of London and other English towns.

Although they are now seldom to be seen in this country, the British Government is probably the largest employer of mules in the world. In every campaign that we have conducted since the Peninsular War these hardy beasts have shared the burdens and the risks of the British soldier. Mules form part of the permanent transport of the Indian Army, and their breeding is encouraged by the Government. In Europe mules are bred extensively in the south of France, Spain, Portugal, and Italy, in which countries they are largely used as pack and draught animals. In Spain and Italy they are often used for private carriages, and a well-matched pair of carriage mules frequently commands a higher price than a pair of horses. The mules of Poitou, in France, are famous, and are exported to all parts of the world. The mules of Asia Minor, Syria, Cyprus, Egypt, and Algeria are also good workers, and more than ten thousand of them were enlisted in our campaign against the cruel King Theodore of Abyssinia. In the New World many mules are bred in both North and South America, the Kentucky and the Mexican mules being perhaps the most highly appreciated.

When we consider the natural characteristics of the mule we can easily understand why, in countries where roads are not of the very best quality, it is

preferred to any other animal as a means of transport. "It possesses", says Professor Fleming, "the sobriety, patience, endurance, and surefootedness of the ass, and the vigour, strength, and courage of the horse. As a beast of burden it is preferable to the horse, being less impatient under the pressure of heavy weights, while the skin being harder and less sensitive renders it more capable of resisting sun and rain. It is very frugal, easily fed, and equally good for carrying as for drawing loads; it walks well and steadily, easily traverses the worst roads or paths, will climb or descend a steep mountain or pick its steps by the side of a precipice, with the surety and safety of a goat. For hot and dry countries, especially those which are mountainous, it is well adapted, though cold and wet regions are not suitable for it." In addition to these advantages the mule seems to inherit from its father, the ass, a remarkable freedom from the diseases which in some of our campaigns have swept away horses by the hundred. As a beast of burden the carrying power of the mule depends to some extent, as with all pack animals, upon his training and handling, as well as upon the even balance of his load. Under the most favourable conditions a good mule will carry, in ordinary service, nearly a third of his own weight. In South America an average burden is from 150 to 200 pounds, and this is carried 15 miles or more in a day, at a rate of rather more than 3 miles an hour.

Curiously enough, the laden mule goes faster up hill than down, but like all animals, man not excepted, he suffers badly from the rarity of the air

at high altitudes. Mr. Whymper, in his famous exploration of the Andes, found that his mules began to show signs of distress after reaching a height of 16,000 feet. Staggering under their burdens (which were scarcely more than half the weight they were accustomed to carry) they stopped repeatedly, and by their trembling, falling on their knees, and their general behaviour, showed that they were on the verge of exhaustion. The male mule is sturdier than the female, but is apt to give more trouble to his drivers. Like Thackeray's little girl, the mule when he is good is very very good, but when he is bad he is horrid. He sleeps for only three or four hours out of the twenty-four. Perhaps that may account for the shortness of his temper.

You will wonder, maybe, why, in writing of the fourfooted servants of man, I have not given the first place to that noble animal the horse, which in the most highly civilized countries contributes more than any other to the transport of commerce. The reason is that the horse was probably almost if not quite the last of domesticated animals to be utilized for the carriage of material as distinct from persons. At first sight this fact may seem the more remarkable when we consider that the horse was one of the first animals to be tamed by man, and that it existed in remote ages in nearly every part of the world. The horse's teeth, says Colonel Hamilton Smith, "lie in the Polar ice along with the bones of the Siberian mammoth; in the Himalaya mountains; in the caverns of Ireland, and in Barbary. His bones, accompanied by those of the elephant, rhinoceros,

tiger, and hyena, rest by thousands in the caves in Constadt; in Sevion at Argentuil with those of the mastodon; in Val d'Arno and on the borders of the Rhine with colossal urus (buffalo)."

Both anatomically and historically the horse is the most interesting of all domesticated animals. If an unlearned person were told that there is in existence a quadruped, a cousin of the rhinoceros and the tapir, which gallops about on the tips of its toe-nails, he would probably find himself picturing in his mind an animal closely akin to the species nightmare. Yet the description applies with perfect accuracy to the graceful and familiar horse. What we call the horse's knee is no knee at all, but a wrist or ankle; its "foot" corresponds with your middle finger or toe, its hoof is a toe-nail. In the geological deposits of distant ages, before any signs of man's presence on earth, we find the ancestors of the horse, the rhinoceros, and the tapir bearing resemblances which show them to have been descended originally from the same parents. The horse at this period was a quaint little creature, no bigger than a fox, and he had five toes on each foot. As the ages rolled by he increased in size, and for some reason or other he gradually dispensed with all his toes except one on each foot, that one becoming longer and broader and stronger and the nail thickening and changing its shape, so that by the time man was ready to make use of him he had assumed very nearly the form which you know so well.

It may seem surprising to you that primitive man should have been able to domesticate so spirited an

animal as the horse. You must remember, however, first that in most wild animals fear of man is a gradually acquired instinct, and that before animals knew as much of men as in most parts of the world they do now they would be more readily tamed; and secondly that uncivilized man possesses even in these days a peculiar capacity for snaring and taming wild animals.

In some parts of the world, such as Tartary and the American prairies, the horse runs wild to-day in conditions which must be very similar to those which existed when he was first enslaved by our primitive ancestors. The wild horses congregate in vast herds, numbering many thousand individuals, the whole herd acting with instant obedience to the direction of a single leader, who seems to be able in some wonderful manner to convey his orders to all his subjects simultaneously. The Tartars hunt these wild horses with falcons trained for the purpose. The bird, liberated at the critical moment of the chase, alights on a horse's head, and fluttering its wings in his face, so blinds and frightens him that he is unable to escape with his companions, but stands trembling and bewildered until the hunter comes up to secure him. He is then coupled with the tame horses, and soon learns to obey the commands of his human master as implicitly as he formerly obeyed those of his fourfooted leader.

The wild horse or mustang of the American prairies, the descendant of the horses of Spanish invaders, is generally captured, as I dare say you know, with the lasso—a carefully plaited rope of

green hide, one end of which is fastened to the saddle, the other end being attached to an iron ring. When not in use the lasso hangs in a coil upon the saddle, but on approaching a horse the rider throws the coil over his left arm and makes a noose, 4 or 5 feet long, by slipping the end of the cord through the ring. Then grasping with his right hand the end of the noose that is farthest from the ring, he swings it round his head and lets it fly at his quarry with an impetus which carries it to the full limit of the cord. In practised hands the lasso can be thrown with precision to a distance of 30 feet. When the mustang finds it round his neck he is naturally much annoyed; but the more he plunges and struggles the more uncomfortable his new collar feels, until at last he discovers that unless he stands still he will run a considerable risk of being strangled. Then the hunter dismounts and, keeping a firm hold of the lasso, approaches the nearly exhausted captive. Hand over hand he works his way towards the poor animal, until at last he is able to seize its head and to blow strongly into its nostrils. This last performance so greatly astonishes the horse that it resigns itself, without further opposition, to the loss of its liberty.

In early times the horse was valued, as is still the case among the Tartars, almost as much for its flesh and its milk as for its qualities as a riding or driving animal. In this capacity it seems to have been used only in hunting and in war. As a draught animal it could not compete in roadless countries with oxen and mules. That, no doubt, is the principal reason

why it was seldom if ever used for commercial transport among the ancient peoples of the East. On the other hand, we read of its employment in war from the earliest historic times. Warriors mounted on horseback are depicted on the ancient monuments of Babylonia and Assyria, but the more customary mode of fighting was from chariots drawn by two and later by four horses harnessed abreast. Assyrian monuments even show chariots employed in lion-hunting. The Greek heroes before Troy, you will remember, always fought from chariots and never from horseback; and though Lucretius says that "the custom of a warrior mounting on horseback and guiding his steed with reins and the right hand is older than that of tempting the dangers of war in a chariot", there are some modern authorities who think that the art of driving the horse is older than that of riding it. Saddles were not used until a comparatively late period; only one is represented on the ancient Assyrian sculptures.

In Holy Writ, chariot horses and riding horses are frequently mentioned as used by the Israelites after the time of David. Solomon established a regular trade in horses from Egypt. He is said to have had 4000 stalls of chariot horses and 12,000 cavalry horses. There is, however, but one instance in Scripture of the employment of horses for any other purpose than war or pageantry, and in that instance (*Isaiah*, xxviii. 28) they were evidently not harnessed, but simply driven about wildly over the strewed corn, to thresh out the grain.

Coming to later times and nearer home, we learn

from Cæsar that the ancient Britons had war chariots which they handled with considerable skill. Their horses were probably small but sturdy animals. The Romans, and after them the Normans, brought in horses from many countries, and successive English monarchs made more or less systematic attempts to improve the breeds; but the English horse was many centuries in attaining the pre-eminence which it now enjoys upon the road, the racecourse, and the hunting-field. Lord Macaulay, writing of the state of England in the reign of Charles II, says: "Our native horses, though serviceable, were held in small esteem and fetched low prices. They were valued, one with another, by the ablest of those who computed the national wealth, at not more than fifty shillings each. Foreign breeds were greatly preferred. Spanish jennets were regarded as the finest chargers, and were imported for purposes of pageantry and war. The coaches of the aristocracy were drawn by grey Flemish mares, which trotted, as it was thought, with a peculiar grace, and endured better than any cattle reared in our island the work of dragging a ponderous equipage over the rugged pavement of London. Neither the modern dray horse nor the modern race horse was then known. At a much later period the ancestors of the gigantic quadrupeds, which all foreigners now class among the chief wonders of London, were brought from the marshes of Walcheren; the ancestors of Childers and Eclipse from the sands of Arabia."

Most of us regard the horse as one of the most beautiful of animals. What is to be said in this

Photo Boyer

THE "SHIP OF THE DESERT"

A cotton caravan in Egypt

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respect of that other valuable aid to transport, the camel? Judged by appearances alone it is one of the ugliest and clumsiest creatures that walks the earth; and yet, considered in the light of adaptation to the circumstances in which it lives, it is surely one of the most wonderful. The hideous nostrils, which look like long slits in a lump of indiarubber, and which can be opened or closed at will, protect organs with an extraordinarily keen sense of smell from contact with the hot sand which frequently sweeps across the desert in suffocating dust-storms. The broad, clumsy-looking pad on which the camel's foot rests is the most perfect sand-shoe imaginable. The horny growths on its breast and limb-joints seem to have been developed specially, as no doubt they were, to serve as resting points for the animal while his master piles a load upon his back. The ungainly hump is in reality a store of food—a reserve of fat which can be drawn upon by the rest of the body when other supplies fail; and the great paunch contains a reservoir which enables the camel to travel from three to five days in the hottest sun without a drink. Occasionally, so travellers tell us, the Arab will sacrifice his camel for the sake of the water contained in its paunch. Moreover, the camel's masticating and digestive powers are most admirably adapted for the vegetation of the desert. When other animals are starving the camel thrives, says Sir Samuel Baker, "on the ends of barren leafless twigs, the dried sticks of certain shrubs, and the tough dry paper-like substance of the dome palm—about as succulent a breakfast as would be a green umbrella

and a *Times* newspaper". In short, the camel seems to have been born into the world to serve the needs of man in desert places.

The camel is one of the oldest mammals remaining on the earth, and has the melancholy distinction of being the only representative on this side of the Atlantic of the ancient family to which it belongs, its only living relatives being the llamas, which are confined to the slopes of the Andes and the southern parts of South America. At present it is found Egypt, Abyssinia, Algiers and Morocco, Arabia, Syria and parts of Asia Minor, Central Asia and India, and in these regions it must have been one of the earliest of domesticated animals. It appears on the sculptures of Nineveh, and is often mentioned in the Bible. Rebekah was riding on a camel when she first saw Isaac; and when Joseph's brethren had cast him into the pit they lifted up their eyes and looked, "and, behold, a company of Ishmeelites came from Gilead with their camels bearing spicery and balm and myrrh, going to carry it down to Egypt" —just such a caravan as may be seen to this day in the plains of Arabia. The Arabs cultivate several breeds for different purposes, the chief of them being a stoutly built, slow-paced camel for carrying heavy loads, and the dromedary, the racehorse of its species, celebrated for its speed, and capable of carrying its rider 100 miles in a day.

The training of the camel usually begins in its fourth year, when it is taught to kneel and rise at given signals and to bear loads of increasing weight. A trained beast will carry, according to its size, a

weight of from 500 to 1000 pounds for 25 miles a day. When the deadly sand-storm approaches, the camel sinks instinctively upon its knees and, tightly closing its nostrils, remains motionless, while its driver, covering his face with his garments, crouches under such shelter as its body affords. When the caravan is in danger of perishing from thirst the camel can smell water, if there be any, within a mile, and will go for it even if he has to break his halter to do so.

With all these admirable qualities the camel has, I regret to say, a reputation even worse than that of the ass for stupidity and of the mule for ill temper. "He takes no heed", says Palgrave, "of his rider, pays no attention whether he be on his back or not, walks straight on when once set agoing, merely because he is too stupid to turn aside, and then, should some tempting thorn or green branch allure him out of the path, continues to walk on in the new direction because he is too dull to turn back into the right road. In a word, he is from first to last an undomesticated and savage animal, rendered serviceable by stupidity alone, without much skill on his master's part, or any co-operation on his own save that of an extreme passiveness. Neither attachment nor even habit impress him; never tame, though not wideawake enough to be exactly wild." The entertaining author of *Life Among the Pandies*, quoted by the Rev. J. G. Wood in his Natural History, gives the camel an equally bad character for temper. "Invaluable he is, I admit; likewise hardy, capable of carrying enormous loads for great dis-

tances under a frightful sun, and generally admirably suited for the purpose to which he is put, namely, that of a baggage animal. But to say that a camel is patient, to affirm that this great grumbling, groaning brown brute is neither docile, meek, or sweet-tempered, is stating what is simply not the case; and I have no hesitation in saying that never do I remember to have seen a camel in a good humour or otherwise than in open or moody hostility with the world at large; at least, if outward appearances are to be credited. Watch him when he is being loaded; see his keeper struggling frantically with him, only succeeding in making him kneel down for the purpose by sheer force, and when down only keeping him there by tying neck and fore-legs together tightly with a piece of string; hear him grumbling in deep bubbling tones, with mouth savagely opened, and I think that then at least you will admit he is by no means in as amiable a frame of mind as one could wish. Observe him now that the process of loading is completed, and the string which held him in subjection loosened; up he rises, a great brown mountain, still groaning, still bubbling, and away he goes, madly dashing to and fro, and shaking off tables, portmanteaux, beds, furniture, and baggage in a scattered shower around him; and I think that even his staunchest admirers will allow that neither at this moment is he in what one would call a pleasant humour. After some battling, having been overcome and compelled to carry the load to which he so objected, but not until he has damaged it considerably, Mr. Camel arrives when the march is over

at the camping ground. It is then necessary to make him kneel down to have that load removed, grumbling as much as ever, in opposition as usual, beaten physically, but with soul unsubdued, and internally in a state of rebellion and mutiny, a sort of volcano ready at any moment to burst forth."

Poor old camel! It seems ungracious to hold up to ridicule and contempt so ancient and distinguished a servant of mankind—a servant who carried the Patriarchs of Israel on his back, who marched with Xerxes into Greece, and who contributed more than any other quadruped to promote the commercial grandeur of the golden East. But a bad name will stick. In modern slang an ill-humoured person is said to "have the hump": I am afraid that as long as the camel has his, he will be a byword for a cantankerous temper.

The sight of a large camel caravan moving slowly, solemnly across the burning desert, stretching as far as eye can see over the red wastes, must be one for memory to hold through life. Yet so they move, trains of several hundreds of beasts laden with coffee, dates, figs, spices, drugs, strange carpets and wondrous fabrics, precious stones; move from camping ground to camping ground across the plains of Africa and Arabia, as surely and as regularly as the goods trains rumble over our own sweet countryside. They have their times for assembling, for moving on, for breaking up. They always follow the same lines; they have their junctions, where the trains divide for many markets. They have been the goods trains of the desert places of the earth for centuries, and doubtless

they will hold their place in the world's traffic for centuries yet.

Timbuctoo, the great city of the Soudan, is a very famous entrepôt for caravan traffic. We sing of Timbuctoo and jest about it, so that the name is as familiar in western ears as Philadelphia; but if we are suddenly confronted with the question, "Where is Timbuctoo?" most of us are staggered by our own ignorance; and we have to think hard before we can answer, vaguely, "Oh, in the desert somewhere!" For, though Timbuctoo has been on the map of Africa for a long time, it has been seldom visited by European travellers. Like Lhasa it is one of the forbidden cities of the world, and our knowledge of it is still very limited. Once upon a time this great trade centre, standing on the fringe of the Sahara so far from everywhere that counts (according to our notions), was not only far more important than at present, but must have ranked as one of the largest cities in the world. Even now, though but a skeleton of what it once was, it has a circumference of about three miles. Its houses are mud hovels, yet it has magnificent mosques. Its inhabitants are savages and semi-savages—Berbers, Tuaregs, and a dozen other desert peoples; but in spite of this, this strange city has a close connection with Britain, is bound to us, not by love, nor by diplomatic treaties, but by the tie that binds all countries—the world-wide tie of commerce and the instrument of commerce with which this book deals. Your knives are wanted in Timbuctoo, oh Sheffield! What shall the camels bring you in return? Gold or ostrich feathers, ivory or

sweet-smelling gums? Do up your bales with care, dame Manchester, for the heat and cold of the desert journey will sorely try the worth of your cotton goods. And you, Miss Birmingham, what message will you send to the mystic city along with your packages of smallware?

Felix Dubois, a great French explorer of northern Africa, has written a very famous book about Timbuctoo. "Timbuctoo the Mysterious" he calls it. The port of Timbuctoo is Kabara, on the Niger, a busy place with quays littered with bales and sacks of merchandise, loading and unloading. Every day, and apparently only once every day, a procession sets out for Timbuctoo from Kabara, a distance of 5 miles. The procession is composed of people of all classes and nationalities, donkeys, and camels, protected by bands of armed soldiers. Dubois tells us: "A great part of the trade is in rock salt, derived from the mines of Taoudenni, near Timbuctoo. Large caravans from Morocco, Algeria, Tunis, and Tripoli, numbering from 600 to 1000 camels, and from three to five hundred men, arrive from December to January, and from July to August. Their freight represents from six hundred thousand to a million francs' worth of goods. Smaller caravans of sixty or a hundred camels arrive all the year round, and between fifty and sixty thousand camels encamp annually in the caravan suburb before the northern walls of the city."

Sometimes camels are harnessed to wagons, or to a sort of omnibus. Travelling in such conveyances is considered to be a vast improvement on riding on the

beast's back. For myself, I fancy I should feel like a timid passenger in a small ship on a rough sea, and should prefer to be on deck.

Probably the most comfortable method of camel travelling is that adopted by the dwellers on the dreadful Kirghiz steppes of Turkestan, where in winter-time a dwarf species of camel is used to drag sledges over the deep snows.

I have already mentioned the llama as the only living relative of the camel. Four species of this animal are found in a wild state in South America, and one of them, the yamma, is used a good deal in Peru as a transport animal. I may mention here that although the horse, as geological discoveries have proved, abounded in remote ages in the New as in the Old World, it had entirely disappeared from America before the introduction of man into that continent. When the Spaniards invaded South America the horses they brought with them were viewed by the natives with as much astonishment and alarm as the elephants of Pyrrhus had excited eighteen hundred years earlier among the Romans. The peoples of Mexico and Peru had never seen or heard of the horse, and there was no record of such a quadruped in the hieroglyphics of their ancient monuments. Their only domesticated hoofed animal was the llama, which, as I have said, is still in use in those countries, although as a beast of burden it has been to a great extent supplanted by the ass, the ox, and the mule. In general appearance the llama resembles a sheep almost as much as a camel. It has no hump, but it bears its share of the camel's

ELEPHANT TRANSPORT IN CEYLON

The photograph, kindly lent by Messrs. Marshall, Sons, & Co., Ltd., of Gainsborough, shows one of this firm's boilers being transported over a bad road in Ceylon.

reputation for ill humour. Moreover, it has an extremely disagreeable habit, as you may see any day at the Zoological Gardens, of spitting in the face of persons whose presence is obnoxious to it. It is said to be capable of carrying a load of 100 pounds for 14 or 15 miles a day. The Spaniards employed these animals extensively in South America, using, it is said, as many as 300,000 of them at one time to convey ore from the silver mines of Potosi to the sea.

The only other quadruped which merits serious consideration as a means of transport is the elephant. Two species of elephant, the African and the Indian, are the sole surviving representatives of a family which was once distributed throughout the world almost as widely as the horse; and of the two species the Indian elephant only is now employed in the service of man. The mammoth, the ancestor of the Indian elephant, must have been at one period quite a common object of the English landscape, for his remains have been found abundantly in these islands, where he coexisted with the early human inhabitants. In Siberia his tusks are found so frequently as to form an important article of trade, supplying, it is said, nearly all the ivory used in Russia.

For ages the elephant has ceased to be a native of Europe, and has confined himself to the tropical areas of Asia and Africa. He is not represented among the hieroglyphics of ancient Egypt; he is not mentioned in the Homeric poems nor in Holy Writ, though in both these works there are references to his ivory. He appears, however, in the earliest records of the monarchs of India, by whom he was used

chiefly for war. Elephants figured in the Asiatic armies opposed to Alexander the Great, three hundred and twenty years before Christ. Forty years later, when Alexander's kinsman Pyrrhus invaded Italy, he brought with him elephants, and defeated the Romans by their aid. Ere long the Romans themselves learnt to use elephants in war, while exhibitions of their sagacity frequently entertained the populace in time of peace. They were called "Lucanian oxen". In the second Punic War, when Hannibal crossed the Alps in 218 B.C., he took with him a large elephant force. Livy tells us that there were thirty-seven of them. In Philemon Holland's translation of Livy he says that the elephants "had much ado not to topple on their noses in the sloppy snow-broth". Cæsar is said to have brought an elephant to Britain, and to have used it in forcing the passage of the Thames when the Romans were opposed by Cassivelaunus. The Romans caused the elephant to advance, wearing an iron coat of mail, and carrying bowmen and slingers in a castle on his back, whereupon the Britons fled panic-stricken.

In modern warfare the use of the elephant is confined to the Indian Army, and he has been relegated from the combatant to the non-combatant branch of the service, being utilized mainly for the carriage of mountain guns and the traction of heavier artillery. It is, however, as an instrument of peaceful rather than of military transport that he claims our attention in these pages. In that respect also his services, great though they have been, must be referred mainly to the past, for excepting in the haulage of very heavy

loads in unopened country he cannot compete economically with the horse or the mule. "As a beast of burden", says Sir E. Tennent, "he is unsatisfactory; for although in point of mere strength there is hardly any weight which could be conveniently placed upon him that he could not carry, it is difficult to pack it without causing abrasions that afterwards ulcerate. His skin is easily chafed by harness, especially in wet weather. Either during long droughts, or too much moisture, his feet are liable to sores, which render him non-effective for months. . . . His eyes are also liable to frequent inflammation. . . . On the whole there may be a question as to the prudence or economy of maintaining a stud of elephants for the purposes to which they are assigned in Ceylon. In the rude and unopened parts of the country—where rivers are to be forded, and forests are only traversed by jungle paths—their labour is of value in certain contingencies, in the carrying of stores and in the earlier operations for the construction of fords and bridges of timber. But in more highly civilized districts, and wherever macadamized roads admit of the employment of horses and oxen for draught, I apprehend that the services of elephants might with advantage be reduced, if not altogether dispensed with."

In short, the domesticated elephant, surprising as the fact may seem, in view of the thickness of his hide and the immensity of his bulk, suffers from a delicate constitution. Moreover, his appetite being in proportion to his size, he is a very costly animal to keep. For these reasons his employment as a beast of burden is gradually decreasing. Nevertheless in all

work which requires the application of great strength combined with singular judgment the elephant is supreme among quadrupeds. He can be trained to build a wall of stones, course by course, not less evenly and far more quickly than you or I could build it; and he will pile logs of timber with a regularity that could not be surpassed by the most expert lumberman. Indeed, the elephant's services to transport have been no less great in the construction of bridges and roads than in the ordinary conveyance of commodities.

CHAPTER III

Roads and Roadmakers

I SUSPECT that the first transport problem which presented itself to man was in connection with the filling of his larder. Picture to yourself your very great-grandfather of the Pleistocene age waiting for his dinner. He has marked the trail of the mammoths or the mastodons to their watering-place, and he lies out on the overhanging branch of a tree waiting for the beasts to come past for their evening drink. Soon the tramp of heavy feet is heard, and the head of the procession appears. Your elderly ancestor (of course he was not elderly then) lies still, grasping more tightly the blade of flint which is in his right hand. One by one the huge animals tramp along beneath him, their backs almost touching the bough on which he is hidden. The last is already passing when, slipping down from his perch with the agility and silence of a cat, he seizes its tail with one hand, and with the other drives his blade into the flesh on the inside of the thigh, where the hide is thinnest. The animal is surprised and annoyed. Something, it does not understand what, has scratched its leg. To get rid of the thorn, or whatever it may be, that has hurt it, it gives a twenty-horse-power kick with the injured limb. "Crack!" goes the thigh muscle

already half severed by the flint, and in a moment Behemoth lies floundering on his back at the hunter's mercy. That is the way in which the Somalis kill elephants at this day; it was the way, Pliny tells us, in which the ancient African cave men killed them, and there can be little doubt that the trick is a survival from Prehistoric ages.

Having killed his big game and eaten as much of it as he could, the primitive hunter would find himself face to face with the question of transport. If he left the carcass where it lay, it would attract the appetites of countless wild beasts. If on the other hand he could remove it to the neighbourhood of his dwelling, or some other place of comparative security, it would afford him meat for many days—in an arctic climate for months. He would naturally try to save as much of it as he could. The tusks, teeth, and bones would be useful to him for making weapons, but these, if there were no other men about, would stay where they were until he wanted them. The hide he must remove at once, and as much of the meat as possible. I think his natural course would be to skin the carcass, to lay upon the skin or a part of it what a butcher calls the "primest cuts", and to drag his booty laboriously home, using the hide, in fact, as a sledge. In course of time he would discover how to make a better sledge on the plan of that used by the Eskimo to-day. This sledge has two runners of wood or bone, united by cross-pieces tied to them by hide thongs. Maclure relates an instance in which two salmon, frozen as hard as the ice itself, were successfully used as runners.

The ingenuity of European explorers has improved the materials of the Eskimo sledge, but has not modified the ancient principles of design. In countries which can offer a more level field of snow than is generally to be found in the Far North, and in which bigger animals than dogs are available—for example, in Scandinavia and other parts of Northern Europe, in Siberia and in Canada—much larger and heavier sleighs are used for winter traffic. For transporting a heavy load downhill or on a hard level surface, even if not snow-covered, a sledge of some sort is better than no vehicle of any sort. This fact and the ease with which a sledge can be made point to the use of this contrivance, as I stated in Chapter I, long before the invention of the wheeled vehicle, and probably before the practice of placing burdens upon the backs of quadrupeds. When Prehistoric Man began to domesticate the animals, to harness them with thongs to his sledges, and to accustom them to carry loads upon their backs, he was farther advanced in the science of transport than some of the savage peoples who are to be found in the world in our own time.

The invention of the wheel and axle, though its date and place are hidden in the dark mists of the remote past, marks a stage in man's progress no less important in its way than the discovery of steam power. The first wheel, perhaps, was a loose roller—a piece of the trunk of a small tree, roughly smoothed with a bronze or iron axe, and laid beneath the burden which was to be moved. The great blocks of stone used in building Stonehenge were probably

transported in this way, on a number of loose rollers, each roller as it escaped at the rear of the burden being brought to the front again by hand. We know that this method was employed in ancient Egypt for the overland transport of building materials, and it is commonly practised in our own time and country whenever pieces of machinery or other heavy articles have to be moved a few yards without the assistance of a crane.

Prehistoric Man, in places where suitable timber grew, would find that with the aid of a round log or two he could haul a heavily laden sledge over ground which was otherwise impassable. When he discovered a means of attaching the roller beneath the sledge in such a way that it would revolve freely without altering its relative position he had invented the cart. You will readily understand, however, that for general purposes of transport a primitive vehicle of this sort would be of little value as compared with a beast of burden. The utility of the wheeled vehicle depends upon two conditions, namely, the skill with which its design and construction are adapted to the work it has to do, and the quality of the surface upon which it travels.

The designing and building of a light vehicle require a high order of human intelligence as well as ability in the manufacture and use of tools. Nevertheless, when the first pages of history are opened and the veil is lifted upon civilized man, we find that in one part of the world, at all events, the arts of the wheelwright and the carriage-builder were flourishing to a very remarkable degree. The ancient Babylo-

nian and Assyrian sculptures show that beautifully finished wheeled vehicles were in use both for warlike and for peaceful purposes more than fifteen hundred years before Christ. The Egyptian chariot had a wooden framework, the rear end of which rested upon an axle-tree carrying a pair of wheels. The car, which was open at the back, had at the sides and front a rail of wood or ivory, fastened to the frame with leathern thongs. The floor was of rope network, to give a springy footing to the occupants, and the sides were strengthened and decorated with leather binding. The wheels had six spokes, those of peace chariots sometimes had four; and were fastened to the axle by a linch-pin secured by a thong. There were no traces, but the pair of horses wore breastbands and girths. On peaceable occasions, Sir G. Wilkinson in his *Ancient Egypt* tells us, the Egyptian gentleman sometimes drove alone in his chariot, attended by servants on foot. Then the horses wore housings to protect them from heat and insects. For royal personages and women of rank an umbrella was carried by a bearer, or fixed upright in the chariot. Sometimes mules were driven instead of horses, and in travelling sometimes oxen. For travelling purposes the sides of the car were closed.

The Assyrian and Persian chariots did not differ greatly from the Egyptian; but the Assyrian chariot wheels had six or eight spokes, and the cars were more highly decorated. The Persians, besides chariots carrying two persons, sometimes drawn by four horses, used a carriage drawn by a single mule or more, and consisting of a platform on high wheels.

The platform was large enough to carry five or six persons, the driver sitting on a low stool with his legs hanging on each side of the pole. The Israelites possessed few if any chariots until David captured 1000 from Hadadezer, king of Zobah (2 *Samuel*, viii. 4). Thereafter David, and to a still greater degree Solomon, broke through the prohibition (*Deuteronomy*, xvii. 16) against multiplying horses, and organized a force of chariots, large numbers of which were imported from Egypt.

The chariot was, as we have seen, a horse-drawn vehicle, designed first of all for purposes of war. The use of carts for the conveyance of agricultural produce was probably much earlier than the invention of the lordly chariot. What was perhaps one of the earliest forms of the cart is still to be seen in India, where it is known as the suggar. This has two wheels of solid wood, built up of two or more pieces, which revolve upon a wooden axle-tree. The axle-tree is at the fore-end of the framework of the cart, and from it projects the pole to which the oxen are harnessed. The ox carts pictured in the monuments of ancient Assyria and Egypt were an improvement upon this. The wheels of these vehicles had from four to six spokes, and in some cases the axle-tree, as in modern two-wheeled carts, was under the centre of the load. Pliny tells us that four-wheeled carts were invented by the Phrygians at some period before the Trojan War. Perhaps the mule-cart in which, as the Homeric poem tells us, Nausicaa took her linen to the wash was of this kind.

The carts or wagons of the Israelites were probably

built on the lines of those which they had seen in Egypt. Six covered wagons, you may remember, each drawn by two oxen, were used to draw the Tabernacle and its contents during the wanderings in the wilderness. There is evidence in the Bible (*Amos*, ii. 13) that carts were employed for agricultural purposes, but their utility for transport over long distances must have been greatly restricted by the inferiority of the roads. The trade of those days was mostly in goods which could be packed in sacks or small parcels, and for the transport of these, pack animals were preferred to wheeled vehicles. You will remember, for example, that when Pharaoh invited Jacob to come to Egypt, he sent wagons to carry the patriarch and the women and the little ones, but the good things of Egypt were packed upon ten asses, and corn and bread and meat upon as many she-asses.

That there were roads of some sort in those early days of civilization we may take for granted. The word which is translated "way" in our English Bible really means highway or road. The Assyrians and Egyptians, we know, were capable of making very substantial roads when they gave their energies to the task. Herodotus tells us, for instance, that for the building of the Great Pyramid, about 4000 years before Christ, a road or causeway was made between the site of the Pyramid and the quarries of Turah three-quarters of a mile away, and that it was of such a solid character that its construction occupied 100,000 men for ten years. Labour was cheap in those days; there was no Eight Hours Act, and no compensation to pay in the event of accidents to workmen. Never-

theless the idea of opening up the trade of their countries by any general system of roadmaking does not seem to have occurred to the rulers of the ancient East. The reasons for this neglect are perhaps to be found in the level character of the natural trade routes, and especially in the dryness of the climate —circumstances which rendered the ground suitable without any artificial treatment for the passage of beasts of burden. In Egypt, moreover, and in Babylonia, the great rivers Nile, Tigris, and Euphrates afforded a natural means of transit for the building materials, which alone constituted the heavy traffic of the times.

From what I have said, you will understand that the roads of ancient Egypt, Palestine, and Assyria were not roads in the sense in which we generally understand the word, but simply broad, dry tracks pitted with the footmarks of men, oxen, asses, mules, and camels, and furrowed in places by the broad wheels of a village cart, or in time of war by the narrower tires of a thousand chariots. In spite, however, of the poverty of the roads, overland traffic was carried on, many hundreds of years before the Christian era, between Palestine and Egypt and Arabia, and even India. The Phœnician cities of Tyre and Sidon were the great markets of the Mediterranean shore, and thither the caravans came from all parts of the east and south. Would you like to know what wares the merchants brought with them? Turn to *Ezekiel*, xxvii, and you will find a list that shows the extent to which trade and transport had been developed in the Prophet's day. There were slaves and vessels

of brass from what is now known as Georgia; horses and mules from Armenia; ivory, ebony, precious stones and gold from the countries on the Persian Gulf; emeralds, purple and broidered work and fine linen, and coral and agate from Syria; wheat, honey, oil and balm from the interior of Palestine; wine and wool from Damascus; sheep, goats, tools and weapons from Southern Arabia; and from Babylonia "all sorts of things", blue clothes and broidered work, and "chests of rich apparel bound with cords and made of cedar".

The civilizations of the eastern Mediterranean, with their far-flung commerce and busy markets, were doomed to disappear, and the countries which gave them birth relapsed into semi-barbarism. To trace the later development of internal communications we must come farther west, through the intellectual glories of ancient Greece to the engineering triumphs of ancient Rome. The Romans were the pioneers of roadmaking. In directness of course and solidity of construction their roads have never been excelled, many of them after 2000 years of traffic still remaining either as the foundations of more modern roads or, in some instances, as the very surfaces trodden by twentieth-century feet.

The Romans are said to have adopted their first ideas upon the subject of roadmaking from the Carthaginians. Whether this be so or not, there can be no doubt that three or four hundred years before the Christian era they had brought the art of roadmaking to a pitch of perfection scarcely surpassed even in our own day. The Roman roads varied,

according to their importance, from 8 to 15 feet in width. They were made in the following manner: First a shallow trench was dug on either side of the proposed road, to mark its width. The ground between the trenches was then excavated until a firm foundation was reached. If from the marshy nature of the ground no natural foundation could be found at a reasonable depth, an artificial bed was formed by driving piles. Above the foundation the road was built up in layers as follow: First, a layer of stones, of which none was smaller than a modern cricket ball; secondly, a layer, 9 inches thick, of broken stones and lime—a sort of concrete or rubble, in fact—rammed well down; thirdly, a layer, 6 inches thick, of broken bricks and pottery, the pieces being smaller than the stones in the second layer, but, like them, cemented with lime and rammed down; finally came the pavement, composed of large, many-sided blocks of the hardest stone procurable, fitted together with such nicety as to present a perfectly smooth surface. Regular footpaths were raised upon each side of the road and strewn with gravel; stone blocks were set up at intervals to assist horsemen to mount; and milestones were placed along the whole extent of the great highways, marking the distances from Rome.

The most famous of these Roman roads, and the first road ever laid down upon scientific principles, was the Appian Way, the Great South Road of Italy. This magnificent road, which was begun by Appius Claudius Cæcus in the year 313 B.C., led from Rome through Three Taverns and Appii Forum to Capua,

whence it was ultimately extended to Brundusium, the modern Brindisi, 350 miles from the capital. The cost of the road must have been enormous, for the work involved cutting through hills and masses of solid rock, filling up hollows, bridging ravines, and building embankments over swamps. Three hundred and seventy-five years after the date at which the road was begun, the Apostle Paul, as we read in the *Acts*, passed along it on his way to Rome. For at least five hundred years after Christ, long after the devastating inroads of the northern barbarians, it continued in perfect repair; and in spite of age, neglect, and the plunder of its materials, traces of it are still visible in places.

The Romans were not only the first people to make good roads, they were also—if we except the unproved and unprovable claims of the Chinese to this distinction—the first to apply the principle of the arch to the construction of bridges. Bridges of a sort had been built in much more ancient times. Herodotus tells us of a bridge erected by the Egyptian queen Nitocris across the river Euphrates. The river was diverted for the purpose; stone piers were built up, and across them were laid planks. Xerxes crossed the Hellespont on a bridge of boats a mile in length. His first bridge, as I dare say you will remember, was destroyed by a storm, at which he is said to have been so much annoyed that he beheaded the Egyptian and Phœnician engineers who had designed the structure, and ordered 300 lashes to be administered to the rebellious sea which had destroyed it. His second bridge, consisting of a

double line of boats, was more fortunate, and supported the vast army which, according to Herodotus, took seven days and seven nights in crossing it. We have accounts of more permanent bridges built by Darius and Pyrrhus as well as by the ancient Egyptians; but they seem to have been very simple in form, consisting, like the Euphrates bridge already mentioned, of upright piers spanned by planks of wood or large slabs of stone. Even the earliest Roman bridges showed a great advance upon this plan. The first, which was constructed about 600 B.C., was called the Pons Sublicius, or wooden bridge. It was supported on piles scientifically stayed by wooden struts and girders. This is the bridge immortalized in the legend of Horatius Cocles which every English schoolboy learns by heart:

"Hew down the bridge, Sir Consul,
With all the speed ye may;
I, with two more to help me,
Will hold the foe in play.
In yon strait path a thousand
May well be stopped by three.
Now who will stand on either hand,
And keep the bridge with me?"

. . . .

And still his name sounds stirring
Unto the men of Rome,
As the trumpet-blast that cries to them
To charge the Volscian home;
And wives still pray to Juno
For boys with hearts as bold
As his who kept the bridge so well
In the brave days of old.

It is related that the destruction of the bridge on

IN THE OLD COACHING DAYS

At the bottom of the hill; taking off the skid

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(road). Another is "fosse", from *fossa*, a ditch. Wherever in an English country place you find an ancient road or village called "street", or a road between ditches called a "fosse-way", you may be almost certain that you are in the footsteps of the Roman conquerors. Some of the Roman roads are easily traceable to this day. A street in the City of London retains the name of Watling Street, probably in Roman days Stratum Vitellianum, which passed from Dover through Canterbury, Rochester, and London, to Chester and the north, and which can still be traced for long distances. Icknield Street (Strata Via Icenidna) extended across the country from east to west, from Norfolk to Land's End. Ermine Street passed from Pevensey through London and the Eastern Counties to York. The great Fosse-Way led from the south coast of Devon to the Humber, in Lincolnshire. These were the great highways of communication, from which smaller roads branched off in many directions.

I wonder where you live, and what is your idea of a road? Perhaps in the suburbs of a great town where roads are straight and neat, with houses and gardens on each side. Perhaps in a city where roads exist only in name, where miles of teeming thoroughfares lead to other teeming thoroughfares, and Imagination has no place. Perhaps in some semi-rural district where the road figures as an interminable stretch, rendered horrible at all times by uncontrolled traffic. It is only, I think, if you live in one of the bare places of Britain—there are still such places, as yet uninvaded by the train and the builder—that the

romance of the road will be able to call to you clearly; unless indeed you are a poet, and have felt it already of your own accord.

If you are a poet, you do not need to travel far for your road fancies. They will spring up all round you at your call, and will bring before your eyes scenes that have been sleeping for centuries past. Wherever you may be, in the most unlikely places, the road—the highroad that is—has its history, which it is always telling to those who will listen. That is one advantage of living in a tiny country with a long history. So much has happened in so small a space that there is hardly a square mile which has not had its share in the story. But one needs to begin at the very beginning of things, and to do this we must leave the city and the suburb behind us and journey forth.

Let us follow a road of which I know, and let it lead us westwards over the border into Wales. When we have left the railway behind us, our road becomes wilder and badly kept. It is hard to realize that we are still in the twentieth century, for we have left the broad new macadamized road, kept up by the county, and have taken the old road over the hills, shorter and more direct, but made by the neighbouring farmers by the simple means of throwing down stones and leaving it to the carts to roll them in. Even so, the surface is no doubt infinitely better than it was in 1550, for the inhabitants take a little more trouble with ditching and draining now than they did then; but there is scarcely any other visible sign of progress.

We have the landscape to ourselves, we meet no

one. We see farms in the distance; but if we were to go close to them we should probably find they date back to the Middle Ages, when men built houses of solid blocks of stone and timber—houses that would withstand the ravages of time and tempest, or the attacks of a fierce enemy. But there is something else that we see from time to time which takes us back farther still, something older than the houses, though not older than the road itself. Here, right opposite us, is a little knoll, raised from the level of the road by not more than fifty or sixty feet. Trees are growing from it now, giving grace and dignity to what was once very bare and grim. Now it is a pretty little knoll, a pleasing feature of the landscape; once upon a time it was a fort where a few half-naked savages made a desperate struggle for their rights against the irresistible disciplined forces of England. They knew that if they could protect their road their country would be safe. These little knolls occur at every mile or so on the road we are following.

Of course the precursor of most roads was the river, which, by dint of running a little and wearing a little every minute for thousands of years, had worn a flat place between two hills. Savage man came to the river to fish and to fetch water, so gradually a firm path became worn along the river bank. In a slightly higher stage of civilization, when men used sledges, the path became wider and firmer. Rough sledges, little altered in design since those primitive times, are still used in the hill districts of Britain. "Fetching the Fern" is an event almost equal in importance to

the harvest in some parts of Wales. When the bracken droops red and sere, in the brilliant days at the end of September, men take horses and sledges and go up the hillside. They cut the bracken and load the sledges high up above their heads, and then, when they can load no more, the patient, surefooted horses drag the sledges home down places where it would puzzle you and me to keep our balance. Certainly they have an interest in taking the bracken down safely, for it is to make their beds for the winter. No doubt the same thing was done when men first made sledges, only then the bracken was not bedding for horses, but bedding for man, wife, and children.

Now, however, we are following not a river road, but a hill road, driven in a more or less direct line between the two places it connects. As we get farther into the hills the forts cease. The warriors were overcome and their road was captured. They did not, however, give way without a struggle, and intermittent warfare with the hated invaders was kept up for centuries. Unfortunately the defenders had domestic enemies as well to contend with. This road, and a wide stretch of country on each side of it, was infested by the celebrated Red Banditti, who were the terror of the inhabitants and travellers for some years about 1555. So great was the fear they inspired that people would put scythes and sharp-edged instruments across the chimneys before they went to sleep, to prevent the robbers coming down and murdering them. At length a body of soldiers overcame the bandits, and eighty of them were captured and hanged.

When you have the opportunity, take a walk along the highroad in any remote country place, and you will notice many things about it which will convince you of its antiquity. Then when you return to your city street or suburban avenue, close your eyes to the present and try to picture to yourself what the road was like five hundred years ago. I should not trouble myself much about the bandits if I were you, though you may be sure they sometimes put in an appearance; nor about the spiritual fears which used to beset the benighted traveller. No stretch of road lacked its ghost or bogy. Indeed, it is an amazing thing how much superstition still lurks in country places. I was solemnly assured the other day that a certain village I proposed to visit was the worst place for ghosts and spirits in the whole of Wales. But you may be sure that the spectre was a very real terror to the traveller in days gone by, and as he had worked himself into a highly nervous condition before setting out, it is small wonder if he saw what he expected to see.

England being, generally speaking, a flat country, the old roads do not invariably follow the course of a river. They often imitate the flight of the proverbial crow for a number of miles, and when they show any deviation from the direct route it is interesting to try to discover the reason. Our islands were visited as early as 330 B.C. by a gentleman named Pytheas of Marseilles, who has left some account of us and alludes to our chariots. Chariots would have been of no use in a wet, clayey country, therefore tracks must have been raised above the level of the marsh lands. Probably these tracks were formed by piling wattles on the

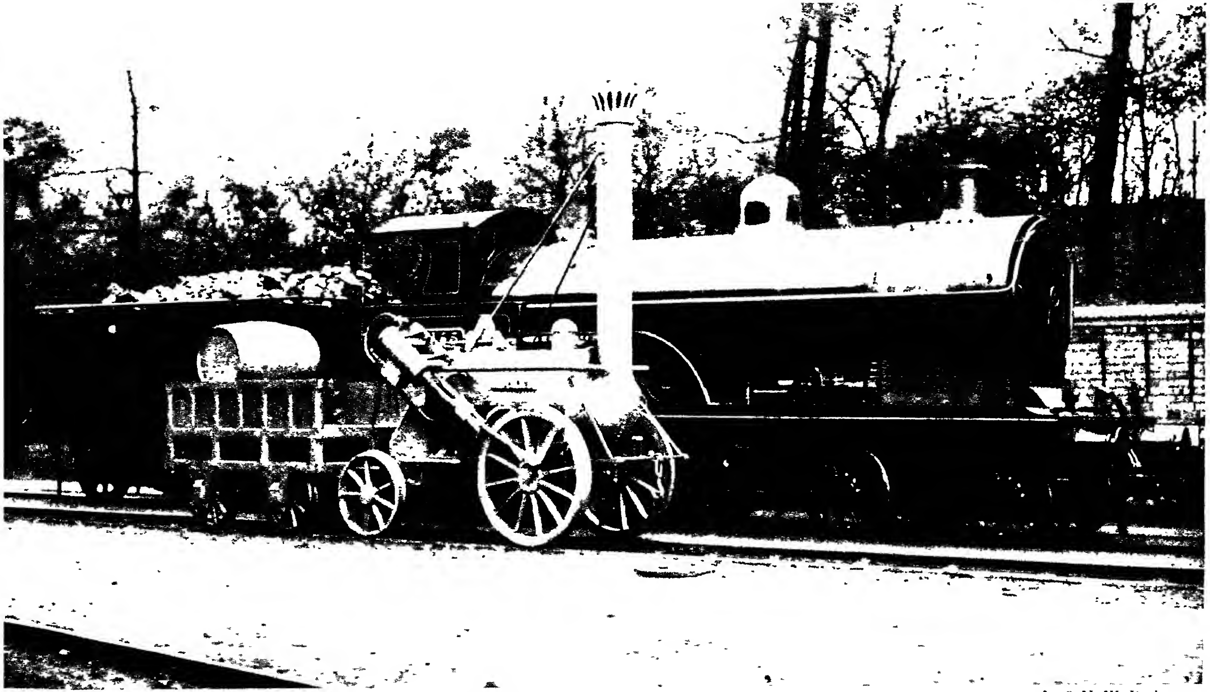
clay, a branch of roadmaking still in use in marshy places. Again, the Britons carried on an extensive commerce with the Continent in iron, lead, and tin, and some kind of road would be essential to the transport of these products. Therefore we find that the general direction of ancient roads is from west to east, for the Britons made their homes on rising ground away from the flat east coast. In some cases the Roman roads followed the line of an existing one, and it is easy to see that the thing they principally worked for was a dry road. Up hill or down dale, it mattered little to them, but the road must be well out of the reach of floods, and so drained that it never became marshy.

The Romans had another point to observe in laying out their roads. The Britons were not yet quite subdued, and would lose no opportunity of striking at their enemies whenever one occurred for a handful of men to damage a disciplined force. For this reason the Romans would never make a road through a forest, for this would entail felling the trees for a wide space on both sides, so that there would be no shelter for spearsmen amongst the branches. Thus, the road from London to Bath made a large circuit to avoid about twenty miles of forest in Buckinghamshire and Oxfordshire. It was not until many years later, when their rule was firmly established, that the Romans ventured to carry their roads through forests, and then they unconsciously wrought, for posterity, almost as much harm as good. They cut down trees which they did not trouble to remove, simply leaving them beside the road. These trees ultimately rotted

away, and the masses of decaying vegetation were largely responsible for quagmires and treacherous lands in the future. In our study of the early roads of Britain, or more particularly England, we must not forget to take into consideration the fact that the greater part of the country was covered by either wood or bog. The inhabitants seem to have escaped one evil only, that of desert.

One feature was common to all the Roman roads—their straightness. They were made for military purposes—for men marching on foot, and horse, and for light chariots—so the engineers carried them as nearly as possible in a bee-line from place to place, regarding as of secondary importance the avoidance of sharp ascents and descents. The Roman chariots and private carriages were much better than those of the ancient Assyrians and Egyptians, but carts and wagons were still almost as clumsy as they could be. They moved slowly and noisily, and often broke down or upset. It seems strange that so clever and practical a people as the Romans did not improve their carts, but instead of doing so they rather discouraged the use of heavy vehicles upon the high-roads, as interfering with the marching of troops and the carriages of the rich. Notwithstanding the excellence of the roads, the pack horse was the principal means of carrying goods. Even pigs of lead and ingots of tin were conveyed on horseback from the mines of Derbyshire and Cornwall to the seaports, from which they were shipped to Gaul or Rome.

It is sad to have to relate that for 1500 years or more after the departure of the Romans the mag-



L. & N. W. Railway

ANCIENT AND MODERN

Model of George Stephenson's "Rocket" placed alongside the latest North-Western Leviathan

Chap. V.

nificent roads which they had made were allowed to fall into decay. As recently as 150 years ago the inland communications of Britain were actually in a worse condition than they had been in the times of the Cæsars. "Down to the middle of the eighteenth century" (says Smiles, in his *Lives of the Engineers*) "the trade and commerce of England were comparatively insignificant. . . . The roads of England were then about the worst in Europe, and usually impassable for vehicles during the greater part of the year. Corn, wool, and such like articles were sent to market on horses' or bullocks' backs, and manure was carried to the field, and fuel conveyed from the forest or the bog in the same way. The only coal used in the inland southern counties was carried on horseback in sacks for the supply of the blacksmiths' forges. The food of London was principally brought from the surrounding country in panniers. The little merchandise transported from place to place was mostly of a light description—the cloths of the West of England, the buttons of Birmingham and Macclesfield, the baizes of Norwich, the cutlery of Sheffield, and the tapes, coatings, and fustians of Manchester."

Well, the Romans came, conquered, made roads, and, in course of time, departed, leaving behind them a country infinitely the better for their rule. Unfortunately there was no one to carry on this wise policy of roadmaking. The roads having been made, they were left to take care of themselves, which is equivalent to saying that they soon became very much the worse for wear. It is hardly too much to say that

in the Middle Ages the roads of England were in a worse condition than those of any other European country. The only mending which they received would be a load of loose stones thrown down carelessly. Until these had worked into the mud, every conveyance suffered the most horrible jolting while passing over them. Then, the State having failed in its obvious duty, the Church stepped in. The proper maintenance of roads became an object of pious endeavour, and it was considered as much an act of grace as feeding the sick and the poor. Richard de Kellawe, Bishop of Durham, in 1311 granted special indulgences to those who took any active part in road repair either by labour or gifts. Other religious authorities followed his example. Some institutions took over the care of a particular piece of highway, others maintained bridges. On the Continent a special order of "Bridge-building Friars" was founded. They did much useful work, the bridge over the Rhone at Avignon being attributed to them. At this time originated the custom of building a chapel beside a bridge and dedicating both to the same saint.

At the end of the fourteenth century a further impetus was given to the work by the resolve of laymen to form guilds for the maintenance and repair of bridges and highways. Hermits also did valuable service by establishing themselves near the highroads and spending their time in roadmending.

Gradually, however, this new-born energy wore itself out. Possibly the clergy found life was becoming too easy for people who had only to make a

sufficiently substantial gift for the good of the cause to be "indulged" for a long period; possibly they found it pleasanter to receive the gifts than to dispose of them as the donors meant. More likely still, people grew tired of giving. Whatever the cause, road-making went out of fashion, and things became worse than ever. It is easy to understand that when the only means of conveyance was the pack horse, and all journeys were taken on horseback, the state of the roads was of little importance; but as commerce and civilization increased the use of wheeled vehicles became more and more common. People became too lazy to walk or ride, and could only travel in clumsy carriages. Heavy carts were required to carry merchandise and provisions into the towns, and the bad roads became so cut and broken up as to be impassable except in dry weather. The common law ruled that the inhabitants of a parish must repair the highways within their boundaries, but so inexplicit an obligation was naturally shelved and shirked. If you ever happen to see, in a clayey district, a road that is in use before being made, you will have some idea of what those old roads of ours were like.

The Romans left Britain in 411, and over eleven hundred years elapsed before any definite system of road repair was organized. It speaks well for the solidity of the Roman roads that after ages of neglect they were still capable of renewal. As we have seen, the only mending the roads had in the meantime was that of private and voluntary endeavour, or half-hearted, and often wholly inefficient, compulsory labour under the common law. The first Act passed in connection

with highways is a statute of Edward I, which did nothing to improve the surface, but is interesting as recalling an almost forgotten aspect of travelling. It decreed that "there be neither dyke, tree nor bush whereby a man may lurk to do hurt within two hundred feet on either side of the way". That was in 1285, and no further notice was taken of the state of the roads until 1346, when Edward III instituted a system of tolls for the maintenance of three roads in London.

Seven years later, "the highway between Temple Bar and Westminster being already rendered so deep and miry by the carts and horses carrying merchandise and provision . . . that it was dangerous to pass upon it", the owners of houses on each side were made to repair it. In 1364 William Philippe the Hermit was authorized to collect tolls for the maintenance of the Hollow Way from all who passed between "Heghgate and Smethfelde". About this time, toll bars were set up in several other places, amongst them being one on the road from "Wooxbridge" (Uxbridge) to London. From this onward the roads began to improve, until in 1663 a very important measure was passed. This was the First Turnpike Act, which only applied to the counties of Hertford, Cambridge, and Huntingdon. In each of these counties surveyors were appointed who had to provide materials for the repair of the roads and enforce the general law that landowners should supply carts, labour, and tools. Tolls were fixed as follows: Horses, 1*d.* each; coaches, 6*d.*; wagons, 1*s.*; carts, 8*d.*; twenty sheep or lambs, ½*d.*; twenty oxen,

5*d.*; twenty hogs, 2*d.*; and so on. These rates seem very high, but it must be remembered that at that time there was only one toll gate in each of the three counties. This system was ultimately developed until the turnpike roads spread all over the country, making history in their course, as we shall see.

Naturally, there was hostility to the paying of tolls, and apparently people would rather do anything than pay for the mending of the roads. In a subsequent chapter we shall have something to say about wheels, but while we are on the subject of roads we must mention that the broad wheels which were compulsory in the reign of George II were expected to have a twofold effect. They were considered less harmful to the road than narrow wheels, which in a soft place would make a deep cut; and also the weight and breadth of them was considered sufficient to roll in the loose stones with which the road was mended. Let us hear what a certain Mr. Bourn has to say on the subject:

"I would recommend having the wheels made in the following manner:—

"Let there be run out of cast iron at the founder's, hollow rims or cylinders, about two feet high, sixteen inches broad or wide, and from one to near two inches in thickness, according to the design or necessity of the proprietor, and the burden he intends them to bear. Let the space or cavity between these cylinders be filled up solid with a block of wood, through the center of which insert your arbor or gudgeon, and leave it two inches and six-eighths at each end longer than the cylinder; which parts must be round, and

about two inches thick, being the pivots, and when the whole is well wedged the wheel is compleet.

"Here then is a solid wheel, which answers all the intentions of a garden roller; now can anything be conceived that would have so happy a tendency upon the roads? to render them smooth and even to harden and encrust the surface, and make it resemble a terrass walk? I say, can anything be equal to these kind of cast-iron rollers to produce the foregoing effects?"

Indeed, so seriously were these suggestions considered that under George III an Act was passed to the effect that vehicles provided with 16-inch wheels should go toll-free for five years, and should pay only half fees afterwards. However, in 1804, William Jessop wrote: "Of all the barbarous and abominable machines that have been contrived by ignorance and maintained by vulgar prejudice, none have equalled the broad-wheeled carriages that are now in use; instead of rolling the roads, they grind them into mud and dust".

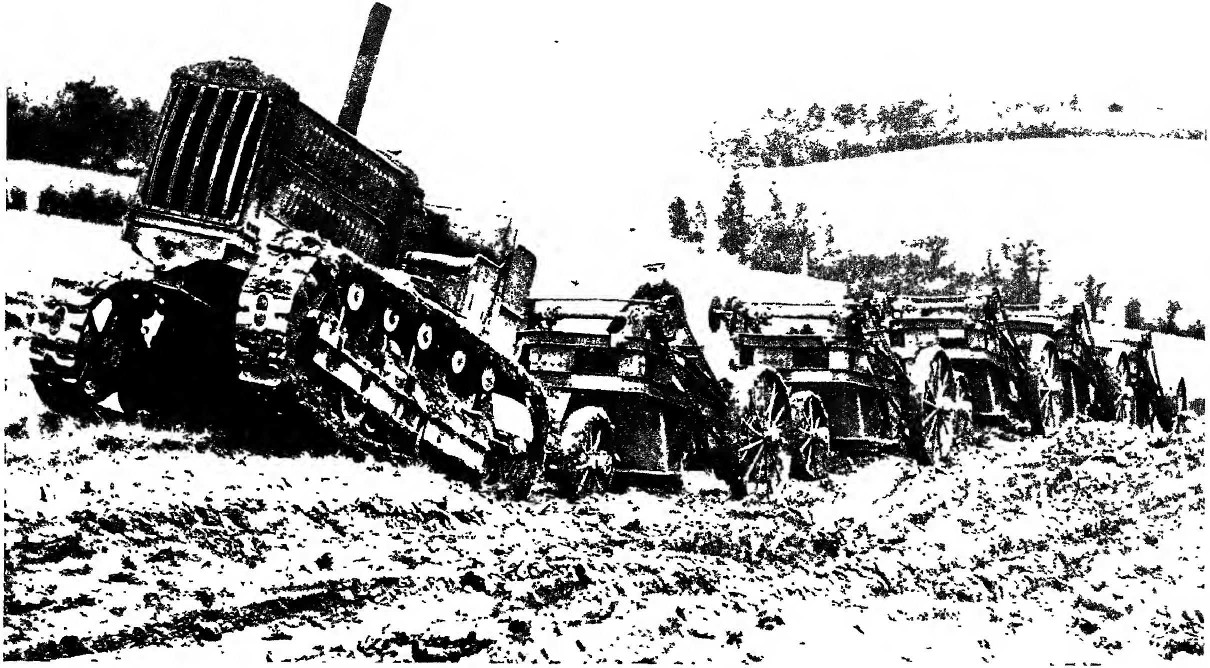
Poor old England! She had commerce and prosperity, an increasing number of people had an interest in her, and yet she had not that first possession of a civilized nation—a good system of inland communication. The objection to toll gates was so great that in many places there were serious riots and the gates were burned down. It is obvious from the number of Turnpike Acts passed that Parliament was seriously concerned about the state of the roads, but it appears that their anxiety was more to mend up the old roads than to provide new ones, which would

be laid in such a way as to overcome the defects hitherto common to all roads. A promise of better things to come was first made in the north of England, and we now meet one of the most interesting figures in the history of our country's development. John Metcalf was born at Knaresboro' in 1717, and became quite blind at the age of six. The only trade which appeared open to him by reason of his infirmity was that of fiddler, but he soon showed that he was possessed of resources which refused to be limited by the loss of one sense. He left fiddling to become a soldier, though of what use a blind soldier would be I cannot imagine. After that he was a chapman, fish dealer, horse dealer—we may be sure he was not "had" more often than his colleagues who could see—and wagoner. Probably it was in pursuit of this last-named occupation that his attention was directed to the state of the roads. We can believe that such a soul as his would gird at having to dig his wagon out of ruts every mile or two in wet weather. Although his system was not new, it was carefully carried out by himself and not left to lazy and incompetent workmen, which is partly, no doubt, the reason why the roads he constructed—amounting to nearly 200 miles—were solid and dependable. His most noteworthy achievement was laying roads across bogs that had never previously been crossed.

The roads were not roads so much as tracks; and when the old tracks became dangerous through depth of mud, new tracks were struck out across the adjoining fields. In 1763 the only public conveyance between Edinburgh and London was one coach, which

set out once a month and occupied nearly a fortnight on the journey. Writing about this time, an English tourist named Arthur Young describes a turnpike road cut up with ruts, "which" (he says) "I actually measured four feet deep, and floating with mud only from a wet summer; what therefore must it be after a winter? The only mending it receives is tumbling in some loose stones, which serve no other purpose than jolting a carriage in the most intolerable manner. . . . I passed three carts, broken down in eighteen miles." Of another road he says: "I was obliged to hire two men to support my chaise from overturning"; and of others: "You will form a clear idea of what these roads are like if you suppose them to represent the roofs of houses and the roads to run across". The highroads of the country at this period were actually worse than those of China and Peru, and were beset by highwaymen who lay in wait where the going was heaviest, so as to take the tired travellers at the greater disadvantage. Matters were little better even in the neighbourhood of the great towns. On account of the mud it took two hours to drive from St. James's to Kensington; and in winter, Manchester and Liverpool, Edinburgh and Glasgow, were for all practical purposes isolated from one another and from the rest of the country.

Sir William Parnell wrote in his *Treatise on Roads*, in 1833: "While, however, England has been content to suffer her roads to be in so defective a state, Scotland and Ireland have acted far otherwise, and for a long time have had the benefit of a more improved system.



CATERPILLAR TRACTOR ON HEAVY LONDON CLAY

The ten-ton caterpillar with a train of five scrapers which are levelling the ground for a new roadway.
Reproduced by permission of Messrs. Tractor Traders, Ltd.

"Lord Daer, eldest son of the Earl of Selkirk, about the year 1790 introduced into Scotland, and more especially through Galloway, the practice of laying out roads with a spirit level. The road from Dumfries to Castle Douglas was traced out by him, so as to have no greater inclination than 1 in 40, although passing through a very hilly country. Mr. Abercromby pursued, as a regular profession, the business of making roads. He laid out the road from Kinross to Perth, and by following the valleys, obtained an excellent line, instead of one passing over a succession of very steep hills. He also laid out the road from Perth to Dunkeld. In all cases he acted on the principle of never making a road ascend a single foot without its being absolutely unavoidable; and this he accomplished by taking advantage of the valleys of the country, and skilfully cutting through high banks and filling hollows.

"Mr. Abercromby made all his roads with stones broken very small. This practice had long existed in Scotland, and is recommended by the old writers on roads in France."

He goes on to say: "Mr. Arthur Young, in his Tour in Ireland, says: 'For a country so far behind us as Ireland to have got suddenly so much the start of us in the article of roads, is a spectacle that cannot fail to strike the British traveller. . . . I found it perfectly practicable to travel upon wheels by a map. I will go here, I will go there; I could trace a route upon paper as wild as fancy could dictate; and everywhere I found beautiful roads, without break or hinderance, to enable me to realize my design.

"'What a figure would a person make in England who should attempt to move in that manner, where the roads, as Dr. Burn has very well observed, are almost in as bad a state as in the time of Philip and Mary.'"

It is rather a curious fact that the first improvement in the means of inland transport in Europe was not in roadmaking, but in the opening of canals. Holland, France, and Russia led the way in this movement. It was not until 170 years ago that the enterprise and wealth of the Duke of Bridgewater and the genius of his engineer, James Brindley, made the beginning of our system of canals, which before the coming of the railway afforded the cheapest and quickest means for the transport of heavy goods. In the closing years of the eighteenth century the country was opened up by about 2600 miles of navigable canals in England, 276 miles in Ireland, and 225 miles in Scotland. The carriage of goods was reduced to one-fourth of the former cost, and articles of utility and comfort which had been previously unknown except among the wealthier classes came into common use among the people. Employment increased, and new branches of industry sprang up. It was then that Britain began to make a name for herself as a country of manufactures.

Passengers as well as goods travelled by the canals, less swiftly, perhaps, but a good deal more comfortably than by coach. A large force of troops was hurriedly dispatched from London to Liverpool in 1806; and the *Times*, in announcing that they

would go by canal, stated that "by this mode of conveyance the men will be only seven days in reaching Liverpool, and with comparatively little fatigue, and it would take them above fourteen days to march that distance".

The opening of the canal system was very soon followed by a vast improvement in the long-neglected roads, or perhaps it would be more correct to say by the first systematic and scientific roadmaking that had been attempted since Roman times. As Brindley has been justly called the Father of English canals, so Telford and Macadam are the Fathers of our modern roads. Telford, like Brindley, was a canal engineer, but it is as a builder of roads and bridges that he is best known to fame. With the aid and encouragement of Parliament, now awakened to the national importance of improved means of transport, he laid out more than 1000 miles of road in Scotland and built about 1200 bridges. In England he constructed the great road from London to Holyhead, including the building of many bridges, among them the famous suspension bridge over the Menai Strait.

Telford compared roads to houses or cathedrals. He argued that as no one would expect a building to stand that had not its foundations firmly fixed, neither ought anyone to expect a road to support the weight of heavy traffic without a solid base to rest upon. Macadam, on the other hand, who was a contemporary of Telford's, paid most of his attention to the surface of the road, and cared little for the foundation. It is to the efforts of these two men, whom we

may paradoxically describe as working side by side on unparallel lines, that the present excellence of our roads is due. The principle of Macadam's system was the use of stones broken very small into sharp pieces. Smooth, rounded stones do not bind, they always remain distinct, but angular stones bind and grind into one another to form a thick crust. This crust he considered would keep dry if it were laid dry, and he did not pay much attention to drainage. It was at this point that the two theories of Telford and Macadam met, and in practice it was soon proved that the methods of both used in conjunction would combine to form a perfect road. I am afraid we do not think much about Telford to-day, but we remember Macadam every time we refer to macadamized roads—that is, roads covered by a layer of "metal" or angular stones.

The work of Telford and Macadam introduced the palmy days of the coaching era, when the "Quicksilver" covered the 175 miles between London and Exeter in the hitherto incredible time of eighteen hours; and when, more marvellous still, the Holyhead mail coach ran from London to Holyhead at an average speed of 10½ miles an hour, including stoppages. Telford died in 1834, Macadam in 1836. They created a great revolution in our inland communications, and they lived to see the beginning of another revolution that was to be greater still. "One of the last works of Telford" (says Smiles) "was the improvement of the highroad between London and Birmingham. He was levelling the top of the hill at Weedon near Daventry, while the railway excavators

were working underneath." Near this spot, and within a few hundred yards of one another, three interesting things are to be seen—the Roman Watling Street, Telford's last road, and the first great railway between London and the North.

CHAPTER IV

Road Vehicles

It is hard to imagine a world without a cart. Yet the earth was old when Homo primigenius gave birth to Homo sapiens, and we must look past tens of thousands of years of Homo sapiens' schooling before we can hope to find that his education had progressed sufficiently to enable him to invent a cart. In other words, a vehicle of any sort is a modern invention. You must not take this to mean that the cart is not many centuries old. Its origin, indeed, is lost in the clouds of mystery that swathe all ancient inventions; but we cannot get away from the fact that the means to make a wheeled contrivance of any sort belongs necessarily to a high state of civilization. We have seen that the discovery of the mechanical power of the wheel was accidental—that a roller, formed by a fallen tree-trunk, first gave to man the knowledge that it was easier to move a load by its aid than to drag or carry it. No one can say how many thousands of years elapsed between this discovery and its application by the Assyrians and Egyptians to their everyday wants. We only know that engines embodying the simple mechanical powers were in the hands of the earliest civilized peoples. The builders

of the Pyramids—pray do not confuse these master engineers with the *earliest* civilization—floated their building materials down the Nile; we do not know how they carried them to the site of erection, but we do know that they must have used pulleys of some sort for hauling the blocks of stone into position. Hence we know also that they were familiar with the use of the wheel and axle, and a wheel and axle is the first stage in the story of the cart, unless, of course, we can stretch our imagination to include the far, far earlier sledge.

What were the first wheels like? Where were they made and by whom? Puzzling questions to answer, these, because we can only answer them by conjecture. A wheel is a complicated piece of mechanism, in spite of its simple appearance, and requires from its maker a high degree of skill and knowledge of carpentry. The simplest form of wheel would be cut from a section of tree-trunk. Next, the early wheelwright would learn to make his wheels whatever size he wanted them by joining several shaped sections together; later, he would join them segmentally. We may be quite sure that the wheel built up of nave and spokes and felloes was a much later invention, by which time chariot-building had been developed to a fine art.

The oldest reference we have to the use of war chariots is in *Exodus*, xiv. 6, 7: "And he (Pharaoh) made ready his chariot, and took his people with him: And he took six hundred chosen chariots, and all the chariots of Egypt, and captains over every one of them."

The Roman chariot (*currus*) closely followed the Egyptian in shape. It was uncovered and built high in the front, and would carry one or two people, standing up. A *biga* was a two-horse chariot, for war or racing, a *triga* was a three-horse chariot, and a *quadriga* was drawn by four horses abreast, two of which were yoked while two were attached by ropes. This was the chariot generally used in circuses and processions. The *currus triumphalis* was of distinct form, being quite round and highly ornamented. Under the date 55 B.C. in *The Students' Hume* we find the following account of the war chariots of the ancient Britons:—

"They (the Britons) fought from chariots . . . having scythes affixed to the axles. The warrior drove the chariot, and was attended by a servant who carried his weapons. The dexterity of the charioteers excited the admiration of the Romans. They would urge their horses at full speed down the steepest hills or along the edge of precipices, and check and turn them in full career. Sometimes they would run along the pole, or seat themselves on the yoke, and instantly, if necessary, regain the chariot. Frequently after breaking the enemy's ranks they would leap down and fight on foot; meanwhile the chariots were withdrawn from the fray, and posted in such a manner as to afford a secure retreat in case of need; thus enabling them to combine the rapid evolutions of cavalry with the steady firmness of infantry."

Needless to say, carts came before the more elaborate chariots; but carts are of precious little use when there are no roads on which they may run. One of the

earliest types of cart is depicted in a Saxon calendar of the eleventh century. The picture for June represents "Cutting Timber". Two men are hewing at trees so remarkable as to shape, foliage, and fruit that it is impossible to guess what they are meant for. A third man is airily lifting the severed trunks into a low cart supported by a very solid-looking wheel. Presumably this wheel is one of a pair, but Saxon perspective was no doubt afraid to tackle the other one. At the opposite corner of the picture two strange beasts come stamping on to the scene, chatting amiably as they come. I have a notion that the artist meant them to be oxen.

The one-horse cart as we know it to-day reached its highest development in Scotland towards the close of the eighteenth century. While the heavy and clumsy four-wheeled wagon was the principal means of transporting all kinds of merchandise in England, the Scottish carriers evolved a much lighter and more economical conveyance, which was admirably adapted for the hilly roads of their country. In England the tendency was for the carts and wagons to become heavier and heavier, until the wagon builders' efforts resulted in a machine which served the double purpose of conveyance and road roller, as we saw in the last chapter. These heavy carts and wagons were forever getting stuck in the mud which they themselves helped to bring into being, and it took several horses to drag them slowly and ponderously over the country. In Scotland, however, a far more enlightened view of transport was taken, and it was realized that a moderate load that could be moved quickly by a single

horse was better from all points of view than a load twice as heavy, taking twice the time to travel a similar distance, at four times the cost. For you must know that a horse acting singly will do as much work again as when he is working with another: that is to say, two horses will, separately, do as much work as three horses working in conjunction. Lord Robert Seymour explained that this arises, in the first place, from the single horse being so near the load he draws; and in the next place, from the point or line of draught being so much below his breast, it being usual to make the wheels of single-horse carts low. A horse harnessed singly has nothing but his load to contend with; whereas when he draws in conjunction with another, he is generally embarrassed by some difference of rate, the horse behind or before him moving more quickly or slowly than himself.

Of course, in a single-horse cart a great deal depends on the manner in which the load is built up and balanced, so that the weight shall rest exclusively on the wheels, this matter being of far greater importance than the actual weight of the load. In England the scientific loading of a cart is generally neglected, but in Scotland you may see a carter adjusting the packages composing his load time and time again, until he has them balanced to his satisfaction; while on the Continent single-horse carts are piled high in a manner to astound the stranger, who wonders that the seedy-looking horse in the shafts does not collapse forthwith.

For several centuries in England—at all events in the few favoured districts that possessed passable

roads—huge wagons were used for the conveyance of merchandise. These wagons were capable of carrying loads of 2 tons or more, were constructed of very heavy timber, to prevent them from falling to pieces on the road, and were roofed over with sheets stretched on a light frame to form a high canopy. They were drawn by four or six horses, and travelled at walking pace. The driver—who, by the by, did not drive in the ordinary sense, since there were no reins—either rode on the leading horse, or was seated on a pony which walked beside the horses. There was always provision for passengers on these wagons. They sat or reclined huddled up together on a bed of straw. Often the wagon would stick fast in the deep ruts of the road, refusing all the efforts of the horses, spurred on by the driver and passengers, to move it. Then additional horses would have to be brought up from the nearest village, and the best part of a day might be wasted before the team would be ready to resume its journey. (There is one great advantage possessed by bullocks over horses. They seldom get stuck, and that is probably the reason why bullocks successfully haul great loads in heavy wagons over tracks in South Africa and South America that could not be traversed by horses. Indeed, it is said that in South America bullocks are preferred to horses for heavy haulage. When a load drawn by horses becomes stuck, the animals make violent, jerky efforts to free it, at the risk of breaking the harness and of hurting themselves, or they give the business up as a bad job, and stand in idle helplessness. Bullocks, on the other hand, work slowly backwards and forwards and side-

ways, freeing the wheels of the wagon little by little, as though with an intelligent insight of the trouble and its remedy.)

The first record of a modern carriage is in the year 1280, when, on the entrance of Charles of Anjou into Naples, his queen rode in a small decorated car. Evidently the idea "caught on", and the great ladies who adopted the carriage found themselves being copied by all and sundry, for in 1294 an edict was issued forbidding the wives of citizens to use "chars". In the Luttrell Psalter is a picture of a state carriage of 1330. It seems to have accommodation for about fourteen people beside the driver, and is drawn by five horses. A royal carriage about 1480 looks a most uncomfortable conveyance, and I should imagine that the king sighed for the old days when he travelled on horseback, though in his new coach he was sheltered from the weather. In 1555 Walter Ripon made a carriage for the Earl of Rutland. It was the first of the small "chars" seen in England, and later on he was commissioned to make one for Queen Mary.

Queen Elizabeth's first state carriage was in shape much like the modern ones, but though it had a roof it was quite open at the sides. We are told that Elizabeth "had been seven years a queen before she had any coach". Later in her reign a coach was made for her with sliding panels, so that she could smile on her subjects or shut out the rain as she felt inclined. Even so her coach must have left something to be desired, for on one occasion at least we hear of her complaining of "aching pains" due to having been "knocked about" in her coach. Indeed,

when we think of the deplorable condition of the roads at that time, and the springlessness of the carriage, it is to be wondered at that she ever drove when she might ride or walk. Carriages came into very general use during the next hundred years

By the middle of the sixteenth century they must have been common in France and Italy, though they were not much used in England. In 1560 Pope Pius IV exhorted his ecclesiastics to set their faces against the unmanly fashion of riding in carriages. Whether or not His Holiness was able to check the "unmanly fashion" we are not told; but at least he could not stop it, for the fashion was rapidly becoming a convenience that was leading—however slowly—towards the enlightenment and prosperity of the people, though you must not suppose that the people cared anything at all for that side of the picture.

About 1564 we first hear of long wains or wagons for the carriage of bulky goods, and of people who were not able to travel in any other way. They had accommodation for about twenty persons; they were very slow, and must have been very uncomfortable. The journey from London to Dover took three or four days, and that from London to Bristol six days. These wagons, like the stage coaches, travelled by day only; and the passengers had to find themselves lodgings for the night. This explains to us the use of the huge inns standing, in a decayed and half-deserted condition, on the great main roads. The Oxford road affords many striking examples of this decay of old trades. The stage coaches would stop at definite points with a certain amount of punctuality,

but the wagon slumbered and loitered without much regard for time and the convenience of their patrons. Thus the London to Oxford coach would spend the night at High Wycombe—the "Halfway House" stands just a mile outside High Wycombe—while the long wagons on the second day of their journey might get as far as West Wycombe or Stokenchurch.

The very wealthy only could afford the most luxurious mode of travelling, that of posting, and it is not likely that this came into vogue much before the eighteenth century, when something, however little, was being done to improve the roads. It is calculated that it cost £30 to post from London to Edinburgh. In 1625 we first hear of hackney carriages for hire in London. There were only twenty of them, and they could only be hired from the stables of the owner. It was not until 1634 that they were allowed to remain in the streets and ply for hire. In consequence of this new arrangement the Thames watermen presented a petition to Charles I, the substance of which is contained in the following extract:—

"The hackney coaches are so many in number that they pester and encumber the streets of London and Westminster, and, which is worst of all, they stand and ply in the terme tyme at the Temple gate, and at other places in the streets, and doe carry sometymes three men for fourpence the man, and four men for twelvepence, to Westminster or back again, which doing of this doth undoe the Company of Watermen".

At last the number of private and hackney coaches

became so great that "the streets of our cities of London and Westminster and their suburbs are of late so much encumbered with the unnecessary multitude of coaches that many of our subjects are thereby exposed to great danger, and the necessary use of carts and carriages for provisions thereby much hindered". The outcome of this state of affairs was the importation in 1634 of the sedan chair. The use of this convenient mode of conveyance cleared the narrow uneven streets of a great many clumsy vehicles, to the immense benefit of pedestrians.

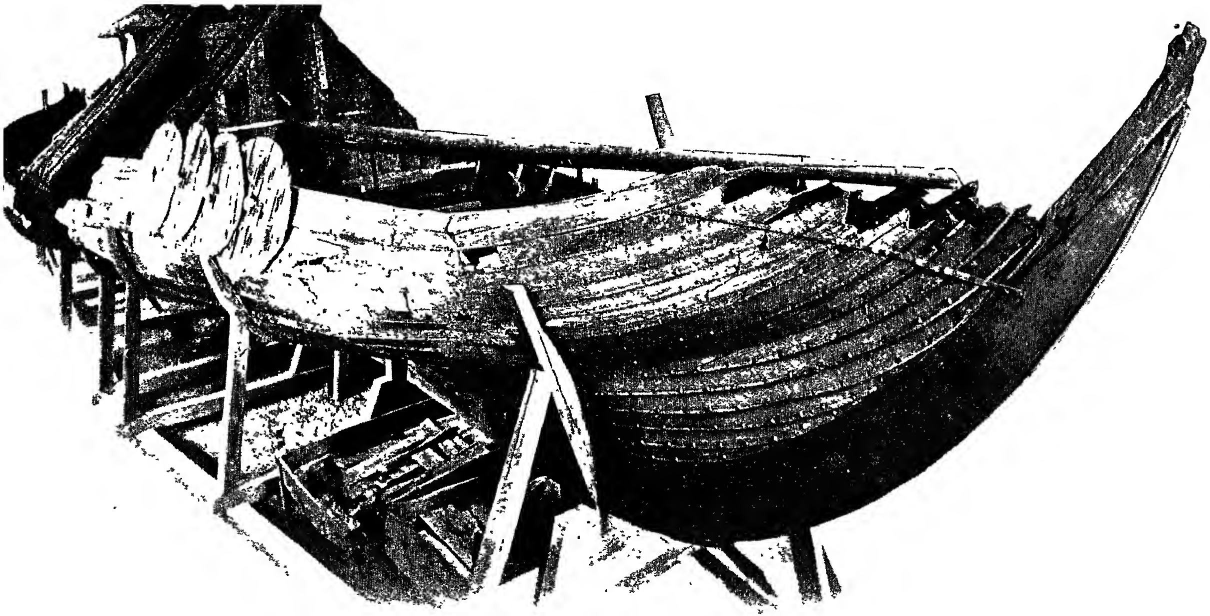
To return to our coaches. The first stage coach set out from Coventry in 1659. It was not remarkable for speed but rather for slowness, its average rate of progression being about 3 miles an hour. The roads were still so bad that it was impossible to go fast, and the coaches themselves were so hard and rigid that anything beyond the gentlest speed would have greatly increased the discomforts of travelling. The mail coach (1784) was the result of the efforts of Mr. John Palmer, manager of the Bath theatre, and, as the name implies, its object was the quickening of the post. By Mr. Palmer's arrangement the journey from London to Bristol took fourteen hours, and from Bristol to London sixteen hours. The scheme was an immediate success, and was soon adopted by all the great towns of the country. The regulation pace was 6 miles an hour, but as Macadam and Telford improved the roads so did the speed increase, until at last it was brought up to 10 miles an hour.

There was, of course, hostility to the coaches. One alarmist wrote: "Travelling in these Coaches can

neither prove advantageous to Men's Health or Business; For what Advantage is it to Men's Health to be called out of their beds into these Coaches, an Hour before Day in the Morning, to be hurried in them from Place to Place till one Hour, two or three within Night; insomuch that, after sitting all Day in the Summertime stifled with Heat and choaked with Dust; or in the Wintertime starving and freezing with cold, or choaked with filthy Fogs, they are often brought into their Inns by Torchlight, when it is too late to sit up to get a Supper; and next Morning they are forced into the Coach so early, that they can get no Breakfast?"

Improvements in coachbuilding were a natural result of the increase in travel and communication. At first, as we have seen, the coaches were merely wooden structures, guiltless of springs, with heavy wheels. The jolts and jerks they sustained in the course of their journeys would have broken up anything less solid and substantial. Early in the eighteenth century a great advance was made by the introduction of leather straps on which the body of the coach was slung. Later on these straps were attached to C springs, and in 1757 we find an advertisement of "a flying machine on steel springs" which was to make the journey from Warrington to London in three days. Elliptic springs such as are used nowadays for carriages were invented in 1804 by Mr. Obadiah Eliot.

Coaching reached its highest pitch in England in the years immediately preceding Queen Victoria's accession. This was a time when, in a period of peace following long and weary wars, the people of



VIKING SHIP FROM GOKSTAD

Now in the University, Oslo

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our country looked about for means of recovering from the weakness and poverty that war always entails—even to victorious nations—and found it in the genius of her inventors. Looms were humming, iron furnaces were roaring, and industrial enterprises were springing up everywhere. And, of course, with increasing trade there came increasing need for travel, and the postal services of the country were generally "speeded up". On all the more important routes the coaches were accelerated until they reached such a state that, in spite of shorter stages and better horses, it was impossible for them to go faster. But, in spite of good going, a journey from London to Leeds occupied twenty-two hours. To-day, the fastest trains of the Midland Railway take something under four hours for the journey between the same places.

Thomas De Quincey has left us a very vivid account of the coaching days in his essay on "The English Mail Coach". The postal service in particular fired him with admiration. Here is one of the pictures he has given: "From 8 p.m. to fifteen or twenty minutes later imagine the mails assembled on parade in Lombard Street, where, at that time, was seated the General Post Office. In what exact strength we mustered I do not remember, but from the length of each separate *attelage*, we filled the street, though a long one, and though we were drawn up in double file. On any night the spectacle was beautiful. The absolute perfection of all the appointments about the carriages and the harness, and the magnificence of the horses, were what might first have fixed the attention. Every carriage on every morning in the year

was taken down to an inspector for examination—wheels, axles, linchpins, pole, glasses, &c., were all critically probed and tested. Every part of every carriage had been cleaned, every horse had been groomed with as much rigour as if he belonged to a private gentleman.

"Every moment are shouted aloud by the Post Office servants the great ancestral names of cities known to history through a thousand years—Lincoln, Winchester, Portsmouth, Gloucester, Oxford, Bristol, Manchester, York, Newcastle, Edinburgh, Perth, Glasgow—expressing the grandeur of the empire by the antiquity of its towns, and the grandeur of the mail establishment by the diffusive radiation of its separate missions. Every moment you hear the thunder of lids locked down upon the mail bags. That sound to each individual mail is the signal for drawing off, which process is the finest part of the whole spectacle. Then come the horses into play."

A noble scene, a stirring scene. Stirring in its movement, in its bustle and its babel; stirring in the fancies it calls up, in its visions of a journey, for a journey anywhere is adventure. And noble, too, because it is the germ of something nobler still, a far, far wider diffusive radiation of the separate missions of the Post Office than the scene pictured by De Quincey. And De Quincey goes on to dilate on the journeys of the coaches up hill and down dale through many miles of much-enstoried landscape; and he who reads feels his pulses beat the quicker, and his sympathies go out to the good old days when travelling was all excitement, and a journey a thing to be remem-

bered and recalled so long as life should last. Ah yes! The brightly painted coaches, the gay liveries, the dashing horses, the hammer of hoofs and the clinking of harness, the sound of the horn and the hum of the wheels, the clearing of streets and the cheering of people as our grandfathers swept on their journeys, were sights and sounds to cherish for many a day. And we may be sure they laughed when by good fortune they beat the rival coach, and at the little incidents of the roadside—the pigs and the fowls that flattened themselves under gates; and they gasped as the leaders swung round a curve, or a wayfarer reached the safety of the ditch in the nick of time.

Surely it was pleasant to bowl through the sweet pastoral lands of the home counties, through the shade of deep woodlands; to feel the sea breeze as they sped by the seashore, to climb over bleak moors while the peewits tumbled and screamed around them and the curlews chorused their lament. And the changing of the horses in some sleepy old town where the ostlers seemed the only people with any business to get through (that they had to get through theirs pretty smartly, you may be sure, since only a couple of short minutes were allowed for the changing), and the clatter and excitement and exhilaration of it all—surely they were as pleasant as De Quincey and the countless writers besides who have told us about it would have us believe? But at bottom, was it so jolly? What about the wet days and the stormy nights, and the aches and pains, the tedium of body and mind that crept on as the milestones dropped back? And the superior inside passengers—so very

superior that they would not condescend to mingle with the "outsides" at the stoppages for meals, and gobbled their food in private rooms—how did these very superior persons fare? How would *you* fare, cooped up for hours in a swaying coach, with the disgusting smell of stale leather to add to your sickness? Did I say they gobbled their food? And in private rooms? You needn't believe it; I don't myself.

We are always meeting with stupid people who lament the passing of the "good old days" and the romance of a hundred years ago; who whine because they can't be conveyed uncomfortably in coaches, but have now to travel in ease along a nasty prosaic railway; who speak of romance with a sigh of regret, as though it were a lately deceased relative, instead of an omnipresent spirit that they could find (would they look) in their hats or boots or bread and butter. Romance didn't die with the mail coaches; he wasn't stifled with steam-engine smoke. When people sigh for romance, it is a sign that they killed him themselves. The mailcoach days were the halcyon days of the English roads; and it needed the birth of the railway system to bring road travel to its highest pitch. It was, in fact, the threat of the ultimate disuse of the roads and all that pertained to them that urged the coach proprietors to quicken their services and lower their fares.

In another chapter we shall tell how bitter was the coaches' struggle for existence with the locomotive, and how hardly the railway pioneers gained the grandest victory ever won in industrial history.

And then, when at length the victory was won, it was a long, long time before wiseacres ceased to shake their heads and lament the decadence of travel, forgetting that wiseacres had done just the same thing two centuries earlier. The locomotives and their trains were hideous and unholy, the tranquillity of the landscape was spoiled for ever by the sacrilegious hands of the railway builders. Horses were doomed to become degenerate, since it would be worth nobody's while tc breed them; and the coachmakers and owners, and the drivers, and the many trades dependent upon them, would become extinct, and the very roads themselves would fall again into the useless state from which Telford and Macadam and their followers had rescued them. People—aye and thoughtful people, too—told these things to one another with perfect good faith, and sadly wept over the grave of road travelling. "Alas!" they sighed, "*our* way of getting about was beautiful; the new way is hideous. Who wants to be whirled along an iron track at twice or thrice the old speed? What good will it do?" And much more to the same effect.

But beauty never graced exclusively a single period of man's progress, nor shall it ever; for beauty, as Emerson said of it, "will come as always, unannounced, and spring up between the feet of brave and earnest men". Which, think you, is the more beautiful: the organization that in 1839 carried a lover's letter to his lass at a cost of a shilling, two shillings, or even five shillings if she lived in the north of Scotland, or that which in 1840 carried the same message for a penny? One of the greatest

blessings of the last century was that conferred on the people by the efforts of Sir Rowland Hill and those who made his scheme possible. It was the railway that made the post a more beautiful thing than that described by De Quincey. In 1839, eighty two and a quarter millions of letters were carried by the post. In 1840, when the penny post first came into force, the number of letters carried was double that of the previous year. The number of postal packets delivered in the United Kingdom in 1925 was 5,770,000,000, or an average number of 134 for each member of the population!

There have been so many stages in the development of wheeled vehicles that we can do no more than glance at the more interesting of them, before we leave the instruments of transport that are past or passing for the mightier machines that make our own lives possible. I am not sure that cabs and carriages for personal travel are entitled to a place in our book. There seems to be a stuffiness and a stodginess about the very names. You know, probably, that our word cab is a contraction of *cabriolet*, vulgarly called cabrioily in our fathers' day. These conveyances were introduced into England from Paris in 1820, but they were invented much earlier than that, for a Count Gozzadini wrote in 1672 that a cabriolet, "an affair with a curved seat fixed in two long bending shafts, placed in front on the back of a horse, and behind on two wheels", was seen for the first time in Florence. We find a similar word in the Norwegian "carriole" and the "calesso" of Naples. The "cabriolet de place" was first used in Paris about the middle of the seven-

teenth century by a man named Nicholas Sauvage. No doubt you know that public conveyances in Paris are called *fiacres*, but you may not know that the word is taken from the name of the house of Nicholas Sauvage—l'Hôtel St. Fiacre. Now St. Fiacre's real name is St. Fiacrach, and he came from Ireland in the seventh century. He lived the life of a hermit at Meaux, where there is still a shrine to his memory. He is the patron saint of gardeners and stocking knitters, so that if you did not know the reason you might puzzle your head for a long time before you could discover why cabs should be called after him. The first cabs for public hire in London occupied a yard in Portland Street, Oxford Street. They made their appearance on the occasion of the king's birthday, 23 April, 1823. The cabriolet was presently succeeded by a queer kind of cab in which two people faced one another and the driver sat on the top. This ultimately gave place to a brougham-shaped cab for two, from which our ancient "growler" was developed.

The hansom cab, so called from the name of its inventor, the architect of Birmingham Town Hall, was patented in 1834. It was originally a square body supported on two huge wheels, about 7½ feet in diameter, and it was of course innocent of the modern sliding front and rubber tires. A three-wheeled cab was licensed in 1887, but never came into favour.

Probably the most luxurious carriage ever invented was the "britska" or "calèche", which was used by our grandfathers—or the few very wealthy ones among them—for the "Grand Tour" that was supposed to

put the last touch to a gentleman's education. These were light vehicles, with long bodies in which a passenger might recline, beautifully upholstered, and fitted with all the devices that the wit of travellers and the skill of coachmakers could devise to ensure luxurious journeying. A good calèche cost between three and four hundred pounds—the price for which a first-class motor car can now be bought.

I have said that the calèche was the most comfortable vehicle ever introduced; and, to find a contrast, I should think the weird-looking affair that graces one corner of a photograph of Seoul, the capital of Korea, that I have by me, must represent the last word in discomfort. The cart in my picture—which also shows an electric tramcar, by the way—has three wheels, and looks for all the world like a nightmare wheelbarrow with the handles pointing the wrong way. It is drawn by an ox, and the eight passengers—they are piled one above the other in tiers, on a sort of platform—do not seem to have any idea that they look in any way uncommon.

The Far East can show us some very queer vehicles—queer to our ideas of what vehicles should be like; how the Chinaman may have regarded an English coach we learn (with a pinch of salt) from that essay of De Quincey's from which I have quoted already:

"Amongst the presents carried out by our first embassy to China was a state coach. It had been specially selected as a personal gift by George III; but the exact mode of using it was an intense mystery to Pekin. The ambassador, indeed (Lord Macartney), had given some imperfect explanations upon this

A CHINA CLIPPER RACING

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point; but, as His Excellency communicated these in a diplomatic whisper at the very moment of his departure, the celestial intellect was very feebly illuminated, and it became necessary to call a cabinet council on the grand state question, 'Where was the emperor to sit?' The hammer-cloth happened to be unusually gorgeous; and partly on that consideration, but partly also because the box offered the most elevated seat, was nearest to the moon, and undeniably went foremost, it was resolved by acclamation that the box was the imperial throne, and for the scoundrel who drove, he might sit where he could find a perch. The horses, therefore, being harnessed, solemnly his Imperial Majesty ascended his new English throne, under a flourish of trumpets, having the first lord of the treasury on his right hand, and the chief jester on his left.

"Pekin gloried in the spectacle; and in the whole flowery people, constructively present by representation, there was but one discontented person, and that was the coachman. This mutinous individual audaciously shouted: 'Where am I to sit?' But the privy council, incensed by his disloyalty, unanimously opened the door, and kicked him into the inside. He had all the inside places to himself; but such is the cupidity of ambition, that he was still dissatisfied. 'I say,' he cried out in an extempore petition addressed to the Emperor through the window—'I say, how am I to catch hold of the reins?' 'Anyhow,' was the imperial answer; 'don't trouble me, man, in my glory. How catch the reins? Why, through the windows, through the keyholes—any-

how!' Finally, this contumacious coachman lengthened the check-strings into a sort of jury-reins communicating with the horses; with these he drove as steadily as Pekin had any right to expect.

"The Emperor returned after the briefest of circuits; he descended in great pomp from his throne, with the severest resolution never to remount it. A public thanksgiving was ordered for His Majesty's happy escape from the disease of broken neck, and the state coach was dedicated thenceforward as a votive offering to the god Fo, Fo—whom the learned more accurately call Fi, Fi."

CHAPTER V

Steam and Petrol take the Road

OF all the wonders that the story of transport can show us, none is greater than the taming of steam. It is the mightiest servant of mankind; without it the world would probably be where it was in the middle of the eighteenth century. You cannot spend a penny but King Steam will take his tribute. Every time you get on to a train or a steamer—aye, even a motor bus—you are expressing by your action indebtedness to the men who burnt their fingers for your benefit centuries ago.

One of these men was Nicholas Joseph Cugnot, a Frenchman to whom belongs the honour of making the first steam carriage—at least the first that would go. This was in 1769. It was a very queer-looking thing carried on three wheels, with a big copper boiler, rather like a tar boiler, in front. It was tried in 1770 in the streets of Paris, on the spot, in fact, where the Madeleine now stands, and the trial was attended by many notabilities of the day. The carriage took four passengers at a speed of about 3 miles an hour—a nice, easy walking pace. I never think of Cugnot but I wish it had been given to me to witness that memorable trial. What did the crowd

of bystanders that saw it, make of the first self-propelled carriage? Were hats flung high in air and voices raised in a tumultuous shout of triumph? Did people cry "Bravo, conqueror of distance! Hail, O tamer of a mightier steed?" No; I am afraid there were no grandiloquent praises for the inventor, but quips and jeers at his expense, and sullen looks or silent wonder as the machine moved on; moved on laboriously, unsteadily—but *of its own accord.* That was the marvel of it, the startling mystery of the life in the ungainly monster.

To us it is infinitely noble, that first rude germ of a power which, in less than a century, was to make a new world; was destined to change men's thoughts and habits, to give us the blessing of comforts and conveniences that our grandfathers never enjoyed. But to the mob that saw the trial of Cugnot's steam carriage there was nothing grand or noble in the spectacle. The machine was sinister, uncanny, an engine of the devil, because it moved by an unknown power. For what knew they of Savery and Newcomen? How many among that Parisian crowd had heard of James Watt's conquest over fire and water, then just accomplished? In all the world there is nothing so harmful as distrust of a greater knowledge than that of our people and our time. Poor Cugnot! His was an ill-timed venture, a stupid enterprise. Why had he not remembered the mad inventor who had been kept out of harm's way in the Bicêtre at Paris more than a century before? "I am not mad! I am not mad!" cried the wretched prisoner of the Bicêtre in 1641. But all the

world thought him mad; and all the world, being peopled by rational men and women, who knew what they knew, and did not believe that there could be more to know, had right on its side. So the Parisians had right on their side, doubt it not, when the condemned Cugnot was cast into prison. Poor sublime genius! what boots it that you, even in your loathsome dungeon, can see more than your fellow men in the light?

Solomon de Caus was shut up in the Bicêtre, the great madhouse; Cugnot was put in prison. The former had an idea, the latter had clothed the idea in wood and iron and copper a hundred and thirty years later. Cugnot was put in prison because his carriage ran into a brick wall and knocked it down, so his judges said; and it provided them with a good excuse for keeping out of mischief a very dangerous man of diabolical works.

"I am not mad! I am not mad! I have made a discovery that would enrich the country that adopted it!" cried the wretched prisoner of the Bicêtre; and the visitor to the madhouse would shudder at the frightful face the speaker presented to him from behind the bars of his cell. "What has he discovered?" the visitor would ask of the keeper; and the keeper was wont to reply: "Oh, something trifling enough! You would never guess it; it is the use of the steam of boiling water. The man's name is Solomon de Caus; he came from Normandy to present to the king a statement of the wonderful effects that might be produced from his invention. To listen to him, you would imagine that with steam

you could navigate ships and move carriages; in fact there is no end to the miracles which, he says, could be performed. The Cardinal sent the madman away without listening to him, and shut him up here, to put an end to his folly."

The year before the trial of Cugnot's ill-fated steam carriage two patents for the moving of road vehicles by steam had been taken out in England: one by the celebrated James Watt, and the other by "one Moore, a linen draper of London". Nothing was done with either of these: Watt was too busy with the improvement of the steam engine, and Moore's plan was impracticable.

We must pass over the plans and aims of several inventors until we come to the year 1784, when the famous engineer and inventor William Murdoch made a model of a steam carriage. This was in appearance like a miniature tricycle. Doubtless you have seen a picture or replica of Murdoch's model; and you may have heard the story of how, one very dark night when the inventor was trying it on a lonely Cornish road, it ran away from him, and meeting a clergyman on its way nearly frightened the poor man out of his wits.

Murdoch got no farther than a model. He was the manager of the great engine firm of Boulton & Watt, and was too busily occupied attending to his master's affairs to have time for experiments with road steam engines.

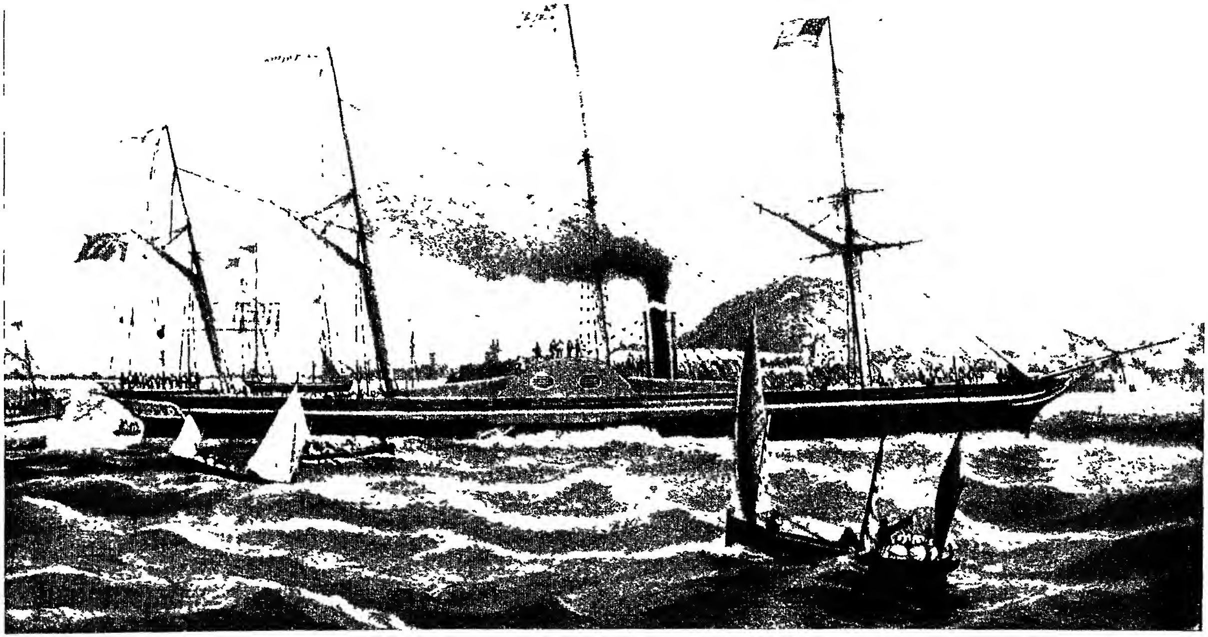
It was left to one of Murdoch's pupils to show the world what could really be done in this direction. This pupil was the great Richard Trevithick

—"Cap'n Dick" he was commonly called by his workmen. Trevithick was born in 1771, and was trained in that peculiar school of Cornish mining engineers which, though it produced some very able men, was as narrow, as bigoted, and as self-complacent as it could possibly be. Fortunately for the world, Trevithick soon broke away from the ideas of engineering that trammelled his fellow mining-captains; broke away so suddenly and in a fashion so startling that in a few years he completely revolutionized the steam engine and the theories that had been built up around it. He was, in a word, a very remarkable man, the greatest mechanical genius probably that the world has ever seen—a greater genius than Murdoch, or more famous James Watt, or George Stephenson—greater even than Brunel, whom he somewhat resembled in the breadth of his ideas and the startling turns they took. Of course Trevithick's contemporaries said that he was mad; that was a tribute to his genius. As I write I have before me a portrait of this mighty Cornishman—mighty in body as well as in mind. He was an enormous man —he stood 6 feet 2 inches high and had a giant's physique; and his portrait shows him to have had a countenance befitting so great a person. It was too heavy to be handsome, but that it was commanding I make not a doubt.

As I look at this picture, the face grows upon me and holds my imagination, so that I feel something of the man's magnificence and less of the littleness that history attributes to him. I can realize the better for its help the grandeur of Trevithick's outlook.

I seem to be aware of the burning impulse that ever urged him to be doing something new, to turn his talents to new channels, fresh designs. And here, too, in this visage—somewhat Napoleonic in its massiveness—is shown the petulance, the mutability, the impatience, the intolerance of meaner spirits that marked the man. The great forehead, broad and high, that makes his eyes seem small by contrast; the nose big, but well made; the heavy, fleshy chin and the strong jaw and the full mouth—all mark his strength and weakness, his genius and the foibles of his genius, if ever physiognomy might be believed.

And what did this great man do? you ask. Well, he did a great many things, both wise and foolish. He built the first high-pressure steam engine, as great an advance on Watt's engines as Watt's were on Newcomen's. He built the first road locomotive that carried passengers in England; and he built the first *railway* locomotive. All these things marked vital epochs in history. Trevithick bore on his broad back the largest and heaviest foundation stones of Britain's commercial greatness; he laid the brightest pieces in the mosaic of the Temple of Trade in which we worship. No statesman he, yet a builder of empire as well as of engines. A humble Cornish churchyard holds his dust, and you would search in vain among cathedral niches to find a tribute to his memory, a blessing on his name. Yet we want no tablet to tell his fame. From the Cape to Cairo, from St. Petersburg to Vladivostock, in English lanes and crowded city streets, every locomotive that draws a train, everything on wheels that goes by steam, speaks to



THE *GREAT WESTERN* PASSING PORTISHEAD POINT ON HER FIRST VOYAGE TO NEW YORK, 7TH APRIL, 1838

The *Great Western* and the *Sirius*, representing rival companies, were competitors in the first Transatlantic steamer race. The *Great Western*, the larger boat, arrived only a few hours behind the *Sirius*, which had three days' start. The *Great Western* had a registered tonnage of 1320 tons; the *Sirius* was of 703 tons.

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us of the two great men who gave them being—the ill-used Cugnot and forgotten Trevithick.

Dick Trevithick was, I think, about twenty-five when he made his first model of a locomotive. And four years later he was building his first life-size steam carriage—the first "motor car" ever seen in England. It was on Christmas Eve, 1801, that the first trial was made. An eyewitness said: "When we seed Cap'n Dick was a-going to turn on steam, we jumped up, as many as could, maybe seven or eight of us. 'Twas a stiffish hill going from the Weith up to Camborne Beacon, but she went off like a bird."

Four days later the engine was tried again, but it came to an untimely end. Trevithick and his companions went into an inn for refreshment and ran the engine—which doubtless attracted a considerable crowd of yokels—into a shed. But while they were enjoying the Christmas fare that the inn provided—I remember that roast goose is reputed to have been the *pièce de résistance*—the shed caught fire, and the first self-propelled carriage was destroyed.

Illustrations and descriptions of this engine have been preserved to us, and it has always been a subject of great interest to engineers, apart from its short but romantic career. To give you some idea of what the engine looked like, let me say that it looked for all the world like the tar boiler you may see when the roads are being tarred or asphalt pavements laid—a cylindrical boiler on four wheels, with a long chimney sticking out of one end of it. Of course it had a lot of arms and legs, for its one cylinder was

fitted vertically into the top of the boiler, and long connecting rods transmitted the motion to the wheels. But its chief interest for engineers to-day lies not in the shape or motion of the engine—it was crude and ugly enough in all conscience—but in the fact that the exhaust steam from the cylinder was carried into the chimney, just as it is in a modern locomotive.

Not many months after the first road engine had come to grief, Trevithick took out a patent for a much more elaborate steam-driven coach. He was joined in this enterprise by his cousin, Andrew Vivian. This coach was built, and proved to be a great success.

I shall not trouble you with a description of it; but it must have been a wonderful thing to behold, if we may judge from an old picture of it—though, mind you, I don't think the artist had any idea of how it really worked. According to this picture, the carriage, made to seat eight passengers, was mounted high above the axle of the two main road wheels, which appear to be between 11 and 12 feet in diameter. The driver occupied an elevated seat in front of the coach, and an engineer or stoker stood on a little platform behind. But its appearance mattered not a bit; the great thing about it was that it went. It puffed and clattered along the roads about Cambourne "faster"—so we are told—"than a man could walk", and created, we may be sure, a great deal of stir on its journeys.

After a time, Trevithick and his cousin decided to put the coach through its paces in London; so to London it was taken, and people had rides on it, and

said it was a very fine thing, withal rather terrifying. The trouble was that nobody wanted to buy it, or to commission its inventor to build others. Besides, by this time Trevithick had grown tired of his toy, and had turned his attention to other outlets for his exuberant talents, so he built a railway locomotive—the first in the world—and a steam dredger, also the first in the world.

Coleridge tells a story of the steam coach's journey to London. It went from Cambourne to Plymouth under its own steam—a magnificent vindication of its inventor's claim to have produced a practical machine, as the Cornish roads are horrible to-day, and must have been yet more horrible 125 years ago—and the rest of the way by sea. The story is that the machine was puffing merrily along the road to Plymouth at the top of its speed—tradition adds that it had just carried away part of the railings of a gentleman's garden—when Vivian, who was in front, saw that a toll gate was closed against them, and called out to Trevithick to stop. Trevithick shut off the steam; but the momentum was so great that the carriage proceeded some distance, coming dead up, however, just on the right side of the gate, which was opened like lightning by the tollkeeper. "What have we got to pay here?" asked Vivian. The poor tollman stuttered and trembled. "Na-na-na-na," was all he said. "What have we got to pay, I say?" cried Vivian. "No-no-noth-nothing to pay! My de-dear Mr. Devil, do drive on as fast as you can! Nothing to pay!"

In the year 1831, when the volatile inventor of the

first practical steam carriage was within two years of his death, the House of Commons, in its wisdom, appointed a Select Committee to enquire into the use of self-propelled vehicles on the common roads. In the year 1831, the House of Commons, in its folly, failed to act upon the recommendations of its chosen guides. Had the legislature as a whole been as clear-sighted as the gentlemen who formed the Committee, England would have led the world in motor construction and in inland communication. Prejudice, narrow-mindedness, and self-interest, however, proved strong enough to sway the law makers, and the industry received such a setback that it was many years before it recovered the lost ground.

We have lost nearly a hundred years! That is the melancholy conclusion to which we are forced when looking into the history of transport by mechanically driven vehicles. For we have seen that horseless vehicles were in existence long before the faithful Commons gave them their attention; and with a feeling of shame we have to own that in the early part of the twentieth century we stand very much where we ought to have stood before the nineteenth century had advanced very far upon its way. We look back to the "good old days", and we see that the men of the period stood deliberately in the way of progress, and denied to England a means of communication which would have developed her commerce, aided her agriculture, and added materially to her prosperity.

It must, of course, be admitted that the motor car as we know it to-day has developed mainly since the

invention of the internal combustion engine; but who is to say that the discovery would not have been made sooner, had not all enterprise been strangled by the attitude of the country to the early experimenters? With the removal of the terrible handicap under which the motor industry had laboured, the genius of man became active; inventive faculties were set at work, and in less than twenty years from the "Motor's Emancipation" we had advanced far on the road from crudeness to perfection. Perfection has not been reached yet; but compare the "oldfashioned"-looking cars of fifteen years ago with the things of mechanical beauty which fill our streets, carry us to the ends of the country, and transport our goods to-day! The motor-driven vehicle in use at the close of the nineteenth century was a primitive, an unreliable, and often a treacherous thing; the car of to-day can be depended upon to go where it is wanted, to travel quickly, and to reach its destination almost with the punctuality of a royal train.

Much of this progress might have been—indeed, it ought to have been—reported many, many years ago, and England might have set the fashion for the world. In the early part of the nineteenth century inventors were busy, with the result that in the "'thirties" about a dozen companies were running steam passenger coaches in various parts of the country. One of the most successful constructors of this period was Goldsworthy Gurney, who owed his inspiration to the Trevithick coach, which, as a boy, he had seen in Cornwall. Gurney's first coach made its appearance in 1827, and was designed to carry six passengers

inside and fifteen outside. A picture of the wondrous vehicle and a detailed description were published in *The Mirror of Literature, Amusement, and Instruction* in December, 1827. This carriage, which was used in the neighbourhood of London, attained a speed of 15 miles an hour. According to evidence given before the 1831 Select Committee of the House of Commons which enquired into the question of steam-driven vehicles on the public highways, Mr. Gurney travelled on this coach from London to Bath and back. In his evidence the inventor claimed that he performed the last 84 miles of the return journey in ten hours, including stoppages. Poor Gurney received but little encouragement from the public. In his way he was performing a public service; but the public, with that stupidity which so often marks the popular estimate of anything new, looked upon him, not as a friend, but as an enemy. Mr. Filson Young, in his *Complete Motorist*, records that "On one of its journeys to Bath the Gurney coach with a number of guests on board was attacked at Melksham, where there happened to be a fair. The people formed such a dense mass that it was impossible to move the carriage through them; the crowd, being mainly composed of agricultural labourers, considered all machinery directly opposed to their interests, and with a cry of 'Down with all machinery!' they set upon the carriage and its occupants, severely injuring Mr. Gurney and his assistant engineer, who had to be taken to Bath in a post-carriage in an unconscious condition."

It also appears from the report of the Select Com-

mittee of 1831 that a number of steam coaches, in addition to Gurney's, had been in daily use on the roads for some months when the Parliamentary enquiry was opened. These were the inventions of Mr. Walter Hancock, Messrs. Summers and Ogle, and Mr. Stowe. Mr. Hancock would appear to have been by far the most successful of these inventors. Both from the mechanical point and from the point of the comfort of his passengers, he made such rapid strides as to outdistance his four rivals. In all he built about ten carriages, and he varied his design considerably. The "Autopsy" (all Hancock's cars had names) resembled an elongated pantechnicon; the "Era" looked like two stage coaches joined together, with a guard's van over the back wheels; and the "Automaton" bore many traces of being the ancestor of the motor char-à-banc, which is such a conspicuous feature of the road to-day.

Between the years 1830 and 1840 steam coaches were running successfully, to the convenience of the public and to the profit of their owners, on many of the common roads. Maceroni and Squire had a coach which ran daily from Paddington to Edgware and Harrow at an average speed of 14 miles an hour; Mr. Hancock had a service of cars plying between Paddington and the city; Mr. Gurney's carriages were running on the Liverpool-Prescot Road, the Bathgate Road, the Ashburton-Totnes Road, and the Teignmouth-Totnes Road. A service of coaches drawn by Gurney tractors was also maintained by Sir Charles Dance between Cheltenham and Gloucester.

One of the most weird-looking objects on the high-

way in those days was William Church's steam coach. Its wheels—a single steering wheel in front, a single one behind, and a pair in the centre—were almost invisible from the road. They were boxed in by elaborately decorated and gaudily coloured panels, which gave the coach the appearance of a glorified circus car. It had accommodation for passengers and luggage in two compartments, and there were garden seats for about twenty persons on the roof, while four privileged travellers occupied a canopied box seat over the steering wheel. This gilded monster took the road between London and Birmingham.

It may well be asked, with so promising a start ninety years ago, how was it that the motor industry so completely disappeared from England between 1840 and 1896? The answer is to be found largely in the prohibitive tolls which were levied on mechanically propelled vehicles, and in the vexatious legislation passed at the instigation of those who were short-sighted enough to imagine that their interests were threatened by this new form of locomotion. The Committee of 1831 reported strongly in favour of the steam vehicles, and foretold that "they would become a speedier and cheaper mode of conveyance than carriages drawn by horses". The Committee was also very sympathetic on the subject of the tolls. It recommended a Bill to regulate the tolls throughout the country, and to show the necessity for such a measure it stated: "The Trustees of the Liverpool and Prescot Road have already obtained the sanction of the legislature to charge the monstrous toll of 1*s.* 6*d.* per 'horse power', as if it were a national object to

prevent the possibility of such engines being used".

The recommendation of the Committee was of no avail, and by 1840 the tolls had increased to such an exorbitant extent that the steam coaches began to disappear from the road. All the profits were eaten up by road charges, and the pioneers, who had other ends in view besides progress and the gaining of fame, gave up the struggle against overwhelming odds. So progressive England dammed the tide of progress, checked the enthusiasm of her ingenious sons, and killed in its infancy an industry from which she might have gained wealth and strength.

After the steam coaches had finally been withdrawn the traction engine made its appearance on the roads, and began to draw heavy loads about the country. They were, of course, too ponderous and slow to be used for passenger traffic, and they were used entirely for transporting heavy material. But the Legislature, goaded by those who looked askance at the travelling monsters, came to the conclusion that a curb must be put upon this form of traffic. Accordingly in 1865 the famous "red flag" Act came into being. This really amazing piece of legislative work enacted that the number of persons required to drive road locomotives should be increased to three; that the maximum limit of speed should be reduced to four miles an hour; that a man should precede each locomotive with a red flag at a distance of a hundred yards; and that drivers should be forbidden to allow the engines to blow off steam in the streets. The result of this Act was to sound the death knell to all motor traffic excepting that of the heaviest kind.

A few men, greatly daring, continued to make experiments, but their trial runs had to be made under cover of night, and like many other men who follow an illegal pursuit in the hours of darkness, they often had to pay the penalty in the police court on the following morning.

Relief came at last with the passing of the Motor Car Act of 1896, which allowed mechanically propelled vehicles to proceed along the road at a speed not exceeding 14 miles an hour. England at last had awakened to the importance of the new means of inland communication; but through her own ridiculous laws she had, in the production of cars, been left far behind France and Germany, where maker and motorist had not been hampered by any vexatious restrictions. November 14, 1896, was the day on which the repeal of the "red flag" Act became effective, and to celebrate so great an occasion an inaugural run from London to Brighton was held. The story of that run, with its numerous mishaps and breakdowns, makes amusing reading now that, with all our thirty years' experience behind us, we can place almost as much reliance on a motor car as we do on the railway.

It is not with the story of the run in general, however, that we have to deal here, but with the fate of one particular car, for in this we see the first of the new-style road transporters. For the best account of the progress made by this transport car we must turn to *Ten Years of Motors and Motor Racing*, by Mr. Charles Jarrott, one of the few motorists of the early days who have taken the trouble to contri-

bute their reminiscences to the romance of motoring. There is so much to be told of the adventures in the "'nineties"—so much that would be historical and at the same time entertaining—that it is a pity that many who strove with refractory and ill-understood cars in those days do not add their contributions to the literature of motoring.

The first transport car in the first London-Brighton run is dealt with by Mr. Jarrott in the following paragraphs, borrowed from the pages of his book:—

"A parcels van was also in evidence, although I do not suppose it ever carried a parcel in its existence, and it certainly looked as if it would collapse forthwith if something larger than a hatbox was placed upon it.

"The van was, as a matter of fact, fitted up as a 'breakdown' van (save the mark!). It contained many things which, in the opinion of the experts, might be required by the various cars on the road, and it was supposed to bring up the rear of the procession to aid any of the cars which were stranded. There was no question about it being in the rear of the procession; it was incapable of being anywhere else. Charles Rush, who was driving, explained to me that he arrived in Brighton on the following morning at 3 o'clock, having spent the best part of his time beneath his car repairing breakdowns on the 'breakdown car'."

It is a noteworthy fact that nearly all the cars which lined up at the Hotel Metropole on that foggy November morning were of either French or German manufacture. Germany had made progress

All over the country, from Land's End to John o' Groats, from the east coast even to the west, the motor cars, wagons, lorries, and tractors are speeding over the roads, bringing the most isolated villages into touch with the towns, finding new markets for merchandise, bringing profits to their owners and no small degree of benefit to those whom they serve.

One of the most notable cases of conversion to the use of the self-propelled vehicle on the highways is that of the railway companies. In the dark days when all the country seemed united in opposition to the motor, it was the heads of great railway concerns who led the agitation against the new form of transport. The fear seems to have been generally entertained by both railway directors and shareholders that the steam cars would spell ruin for the railways, or at least that they would rob them of a great part of their trade. The contrary has been proved to be the case, and the agitation has been shown by events to have been as senseless as that of the ignorant countrymen who shouted "Down with all machinery!" Railway trains can only carry goods to stations and sidings, and means of distribution from these centres must be employed. Therefore in the pre-motor days the railway companies were often the largest users of horses in the towns and cities which they served. Wisely all the great companies have adopted motor wagons for the collection and distribution of goods, and they are also making an ever-increasing use of the motor omnibus to bring in the people from the outlying districts to fill their passenger trains. The railways may have lost a certain amount of revenue

through, the wealthy traveller taking again to the pleasures of the road, and through the competing motor carriers; but they have found ample compensation through the new trade which the motor has brought, and through the old trade which it has developed to a generous degree.

It is perhaps rather surprising, in view of their determined opposition to mechanical road transport, to find the railway companies amongst the largest and most enthusiastic users of what is probably the most economical and least known type of self-propelled vehicle, that driven by electricity. The electric motor van or motor lorry possesses over its steam and petrol rivals certain very clear advantages and equally definite limitations. It is very easy to manipulate and very simple in construction. It is, of all forms of power vehicle, the most economical to run and maintain. It is quick to start, and can accelerate very rapidly, a most important point in crowded traffic centres and in all cases where the delivery of goods entails frequent stopping and re-starting. Unfortunately its range of action is strictly limited by the battery capacity, which in the case of a heavy lorry is somewhere between twenty and thirty miles, and its economical speed is relatively slow. The cost of running an electric lorry is governed by the price of electricity and the facilities for battery charging, and its use at present is almost exclusively confined to railway companies.

One of the most interesting figures in the history of commercial transport is Colonel Rookes Evelyn Bell Crompton. So long ago as 1860, when he was a

Harrow boy, Colonel Crompton was experimenting with models of road engines of his own construction. With the assistance of the local blacksmith, his holidays were devoted to the making of an engine, which was duly completed and took its place in his first road car, the "Blue Belle". In a reminiscent note written for the Motor Museum, opened in Oxford Street, London, in 1912, Colonel Crompton wrote: "As is usual in a boy's design, I did not look sufficiently far ahead, and did a lot of work on the cylinders, frame and pumps, link motion, &c., before I attempted to design the boiler, and to put the whole on the wheels so that it could be run on the road; but eventually I finished the car in its first form, making the greater part of the iron and woodwork myself. By the year 1862 I had obtained some technical knowledge in mechanical engineering workshops, and by the following year I found out the need of the differential gear to enable me to apply the driving power to *both* wheels, and yet allow me to turn corners."

A few years later Colonel Crompton, having passed his army examinations, went to India, and there in his leisure moments he continued his motor labours. Parts of his old engine, new tools, and an improved boiler he had sent out to him from England; and when military duties permitted he worked on, so that by 1868 he had completed a new "Blue Belle". This was probably the first mechanically propelled vehicle to be seen in India, but it was soon to be followed by others, for Colonel Crompton induced the Indian Government (of which Lord Mayo was then the head)

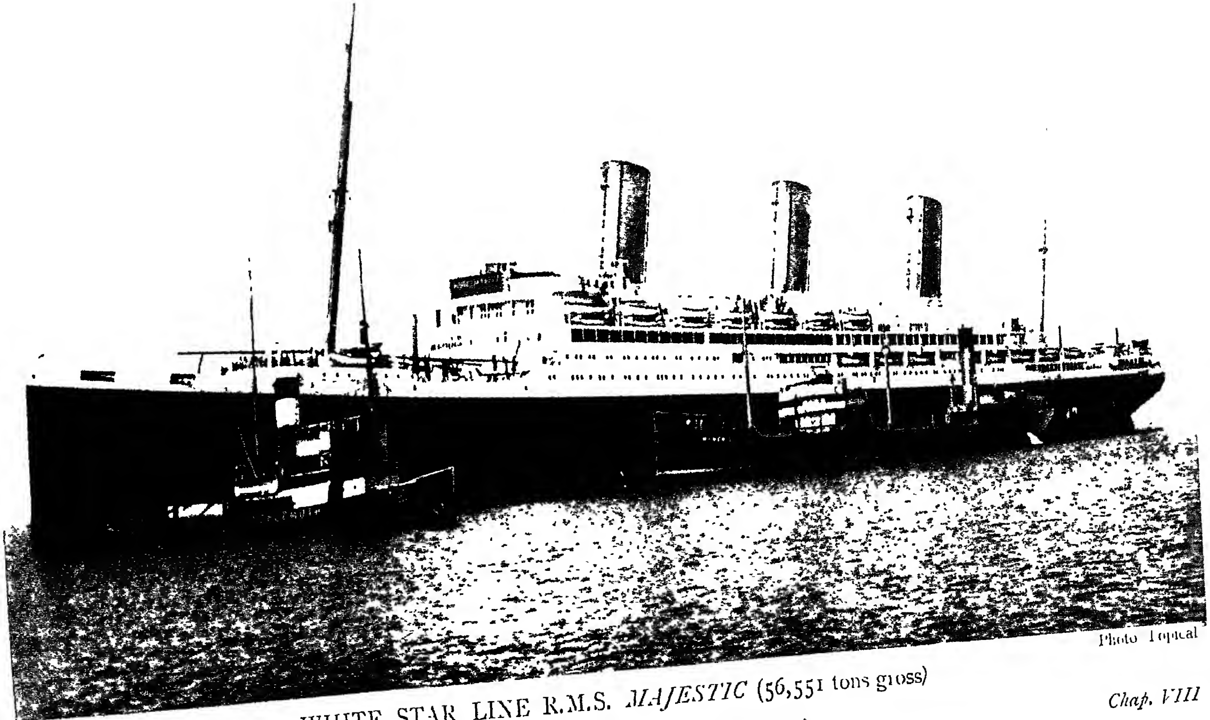

Photo Topical

WHITE STAR LINE R.M.S. *MAJESTIC* (56,551 tons gross)

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The world's largest liner (1927). Length 915 ft. 5 in.

to spend a sum of £1000 in experimenting with one of R. W. Thomson's "road steamers".

The first "steamer" arrived in 1868, and proved so great a success that others were ordered, and the officer who had been instrumental in introducing them was placed in charge of a special department established to control their movements, and to see that they were put to the best purpose. In this work Colonel Crompton found his own "Blue Belle" of great assistance, for he used it as an inspecting engine, and was able to travel about on it and keep a watchful eye upon his other engines.

Colonel Crompton was one of the few engineers remaining to champion the claims of the steam vehicle in the years immediately preceding the war, when the proved efficiency of the petrol motor was driving the more or less experimental steam and electric types off the roads. His main argument for the development of the steam vehicle lay in the importance of the economic factor of the world's petrol supply, rather than the intrinsic merits of the steamer. He looked doubtfully at a fuel that has to be fetched from the ends of the earth and longingly at one that lies beneath our feet; and the problem is undoubtedly a more serious one to-day. But, for certain classes of traffic, the steam vehicle holds its own by reason of its superior efficiency. Of late years there has been a considerable increase in the proportion of steam-driven lorries.

The Commercial Motor Users' Asssociation, under the guidance of Colonel Crompton, has done much to foster the use of mechanically propelled vehicles in

the services which are of so much importance to the private individual.

Our story of mechanical transport on roads would be but half complete if we overlooked the wonderful revolution which has entirely altered the aspect of our city streets, and of London's streets in particular. Seldom has such a mighty change been wrought, in so short a space, as the change that swept into the memories of yesterday an old and once valued public servant—the London omnibus horse. A startling development, truly, is the complete capture of the public carriage traffic by the all-conquering machine. The first of the motor omnibuses of the type now so familiar on the London roads was licensed by the Metropolitan Police authorities in 1904. Previously a service of single-decker cars appropriately called "Pioneers" ran between Marble Arch (Central London) Station and Brondesbury. This was quickly followed by the "Vanguards", which ran their Service No. 1 from Cricklewood to the Law Courts. The London General Omnibus Company was feeling its way carefully at this time, watching the progress of its new rivals, and awaiting its opportunity—when it had found the right type of car—to take its proper place in the carrying of London's millions by motor.

The "General" was wise, as events proved. Many of the early cars were quite unsuited to their purpose. Breakdowns were frequent, and caused endless amusement to the old horse-bus drivers, who steadfastly refused to believe that they and their chargers would ever be superseded. One company after another appeared, disappeared, or was merged in the success-

ful "Vanguard" company. The "Pioneer" company, after trying with a double-deck car, withdrew from the rapidly increasing competition. The "Pilots" and the "Arrows" threw in their lots with the "Vanguards", and for a time the last-named company, the London General, and the London Road Car Company had the field very much to themselves. The London General Omnibus Company was acquiring cars at a great rate, and gradually the horse car was disappearing from all routes. Then came the great amalgamation: the "Generals", the Road Cars, and the "Vanguards" joined forces in one huge concern, which adopted the name of the premier omnibus company—the London General Omnibus Company, Ltd. The wonderful progress of the motor omnibus can be seen from the following figures:—

1904—First double-decked car licensed.

1907—	Motor omnibuses	licensed in	London,	1205.
1910—	„	„	„	1200.
1913—	„	„	„	3232.
1923—	„	„	„	5117.

The greater number of these cars belong to the great combine, but there are a few independent companies apparently doing well on the London streets.

In the commonest type of commercial petrol vehicle the chassis is simply an enlarged and specially strengthened counterpart of the usual type, in which the power of the engine is transmitted to a rear live axle through a clutch and gear box. There is a growing number of designs in which the power is transmitted to all four wheels; but there are two

very distinctive types which may be briefly explained; one of them is the automatically-fired steamer and the other the petrol-electric chassis. The one outstanding advantage possessed by the steam engine is its great "flexibility". The expansive property of steam can be utilized "to the last ounce", as engineers say, whereas in the internal-combustion engine the limits within which the force of the explosion can be varied to affect the output of power are much narrower. A low-powered car can climb a steep hill by means of gearing, just as a child can raise a heavy weight only by a wasteful expenditure of energy; a steam car of the same power will be the more economical of the two in proportion as the load increases. It is this superior flexibility that enables the steam-driven omnibus or lorry to take up its load more smoothly in starting, and to "get away" more quickly than its petrol rival. In crowded traffic areas, and in services where frequent stopping and restarting are necessary, these are very desirable qualities.

The automatically-fired steamers are entirely different in appearance from steam wagons of the Thorneycroft, Foden, or Sentinel types. The valves controlling the admission of water to the boiler, liquid fuel to the furnace, and the head of steam to the cylinders are all operated from a single throttle.

The petrol-electric cars also possess the advantages of quickly gaining speed and taking up the load smoothly from rest, and are moreover very simple to drive. An ordinary petrol engine is used to drive a dynamo; this in turn charges accumulators

and drives an electric motor. In some types the final transmission is through a carden shaft to the live axle; in others, two motors are employed, coupled direct to the road wheels, through suitable gearing, thus doing away with the need for differential gearing. The lucky driver of one of these vehicles —which may be seen in many towns in bus services, especially where there are stiff gradients—has neither clutch nor gear lever to worry about, but has only a controller and speed regulator of the usual tramway type. Such vehicles have, however, only a limited sphere of usefulness; owing to the relatively high engine speed necessary, they would not compare favourably with the ordinary type of petrol bus on a long, straight run.

It has been shown earlier in this chapter that Britain was the most backward, amongst all the peoples with great engineering tradition, to take advantage of the opportunities presented by the relative perfection of the internal-combustion engine. The term "relative" is used advisedly, for even to-day the petrol motor is very far from perfection. Though it takes us everywhere and anywhere, expeditiously, cheaply, and surely, it is extraordinarily wasteful and extravagant. Petrol fortunately is cheap; and air, which forms by far the greater part of our explosive mixture, is cheaper still; but probably half the petrol now used would be sufficient to work the same number of really efficient heat-engines. But it is interesting to reflect that this country, though it started so late, now holds first place in the design and manufacture of first-class motor cars; a position that is the more curious by

reason of the fact that the two essentials on which the industry is based—petrol and indiarubber—are both exotic. Many countries make good motor cars, but for general mechanical excellence and efficiency in working, those of this country stand supreme.

A burning question in the motor industry to-day is the world supply of petroleum. The available sources of rubber are literally incalculable, for there are very few tropical areas where rubber cannot be grown; but the known oil-fields are relatively few, and though doubtless there are others as yet unexploited, the demand is increasing at a very alarming rate. It constitutes, apparently, a relatively small proportion of the world's fuel supplies, and yet everyone wants to use it up! Not in motor cars only, but in factories and power stations, and to a rapidly increasing extent in steamships. As oil is a more economical fuel than coal this is not to be wondered at, but it seems all the more necessary that we should turn to an alternative fuel for road transport. As a matter of fact there are at present two possible alternatives in benzole and alcohol. Just as petrol is a distillate of petroleum, so benzole is a spirit obtained from coal when it is distilled. As far as one can see, it appears to offer the best substitute for petrol. It is a more efficient fuel, for one thing, and its supply would derive from the most sensible use to which we can put our coal, for people are slowly beginning to see how wasteful and unhygienic are our present methods of burning it. Indeed, one useful lesson taught by the great strike of 1926, was the vastly increased sunshine records of London and other big

cities, when there was no "soot blanket" above them to obscure the sun! By roasting our coal in retorts, on a much larger scale than at present, we should secure cheaper gas for domestic and factory purposes, cheaper benzole to take the place of petrol, and a very servicable coke-like fuel for the thousand and one furnaces for which gas is unsuitable. Benzole, of course, is now largely used in motor cars, mixed with petrol, and is growing in favour; but the design of engines would need to be altered before it could entirely take the place of petrol.

The other alternative fuel is alcohol. Its great merit is the ubiquity of supply. It can be obtained from a great variety of vegetable tissues—potatoes, beet, saw-dust, weeds even, although it is not suggested that all the weeds of all the gardens of suburbia would ever have a commercial value—whatever contains starch can be transmuted to alcohol. But it does not give satisfactory results in the existing types of motor engine, which would need to be radically altered; and at present the State looks askance at the question of the remission of the heavy spirit duty which would have to precede its production in economic quantity.

One of the most surprising features of the great General Strike in the early summer of 1926 was the comparative smoothness with which the essentials of the nation's daily life were maintained in spite of the sudden and complete cessation of the railway and public transport services. It is a rather startling reflection that the attempt to paralyse the State, through the cutting off of the life-stream of traffic, failed

completely because the hundreds of thousands of motor cars and vans and lorries that the Trade Unions' organization could not control, were brought together to form a marvellously effective substitute at a few hours' notice. With all but a minutely inconsiderable portion of the accepted transport facilities out of operation, the fifty millions of us suffered no real hardship and surprisingly little inconvenience. Great cities like London, Glasgow, Birmingham, and Liverpool ought to have starved in the ten days' paralysis of railways and docks; instead of which they enjoyed their cakes and ale much as usual, thanks to the motor car and the marvel of organization that had been prepared to direct it in the public service.

A part of this wonderful organization had been developed as the outcome of experience in previous railway strikes, but much of it was the result of the way in which the motor "made good" in the war. Very few people are aware of the extent to which the motor helped to win the war. The spectacular tanks and the colossal tractors used by the belligerents for handling very heavy guns became familiar enough to everybody. But at the time even the fighting forces failed to realize the immensity of the organization that transported them, fed them, and brought up their supplies, and the still greater marvel of its flexibility and adaptability. It grew in time to be the envy of our allies and a very definite factor in the defeat of our enemies, whose own mechanical transport service was inferior and less flexible.

Britain's first opportunity of using the motor on active service occurred during the Boer War. The

motor was in its earliest infancy then, and the South African experiences were not encouraging. Motor lorries were in readiness, armour-plated for protection against the enemy's guns. As the lorries, without the armour, weighed 23 tons, it is small wonder that they sank into the veld!

The British War Office was early alive to the possible utility of self-propelled vehicles, and as long ago as 1901—six years before the first motor bus was licensed in London—prize competitions were held with the object of testing the respective merits of different types of vehicles. And although, as the years went by, the motor vehicle gradually established its superiority over horse-transport, it was for many years at a great disadvantage on rough ground. A gun team, for instance, must be able to surmount banks and ditches, ford streams, cross marshes and loose sandy heaths. These things the motor could not do. The War Office continued to hold trials, at which there competed vehicles fitted with all manner of ingenious devices for surmounting obstacles and extricating themselves from difficulties. There were "Caterpillars" carrying an endless track, which they laid as they proceeded; engines with "feet" which helped them to "step" when a wheel could not hope to turn, and tractors which could scale an almost perpendicular rise, or climb from a ditch.

The enormous development of military motor transport by the British army in the Great War is well illustrated by the following table, taken from *Motor Road Transport for Commercial Purposes*, by John Phillimore. The table shows the expansion in the

use of various classes of vehicles on the Western Front from September, 1915, to January, 1918:

	Sept., 1915		Jan., 1918
Tractors	108	...	1,045
Steam waggons	235	...	835
Lorries	9400	...	32,650
Cars, light pneumatic-tyred vans	3900	...	13,300

The general reliability of the vehicles may be gauged by the facts that in 1918, nearly up to the time of the Armistice, 90 to 91 per cent of the operating lorries were in running order, and that only about 600 lorries out of the total of 32,600 that went over to France were condemned as being totally unfit for service.

As showing how fine an achievement was the building up and the maintenance of this great fleet of motors, the author of the book just mentioned says: "The organization included 88,000 men, operating 60,000 vehicles of all types, consuming in the year 1918, 80,000,000 gallons of petrol, over 400,000 tyres, and about 10,450 tons of spare parts. The territory covered was as large as half of England, and the food, ammunition, guns, &c., supplied were for over 2,000,000 men. It was beyond question the greatest organization and employment of mechanical transport ever carried out under British control, yet the people in Great Britain did not realize it. This was not unnatural, because those at home had no chance of seeing any but home transport, and also because many War Office details and figures could not be made public during the war."

It is not thirty years since the Parliament of this country enacted—in the face of intense opposition—that mechanically-propelled vehicles might move along the roads at a speed not exceeding 14 miles an hour. I read to-day that the driver of a thirty-seater motor coach had been (very properly) heavily fined for overtaking traffic at a busy cross-roads at a speed of over 30 miles an hour. Now that is not an uncommon speed for motor coaches, and not necessarily a dangerous speed; but everyone knows, of course, that the question of speed—and with it the whole security and efficiency of motor transport—is governed by the condition of the roads. Given suitable roads, we might have not only cars and motor cycles, but commercial vehicles as well, bounding merrily along at, say, 60 miles an hour. And in one way that would be a good thing for the community, tending to reduce the cost of transport, and consequently the ultimate cost of all commodities. For (as you can see for yourself) every vehicle would then have three times its present carrying capacity. Roads, however, are very expensive necessities. We might quite usefully spend hundreds of millions on them if we could afford to. As it is, the upkeep and improvement of the highways of the country are now costing, in round figures, £40,000,000 a year. Sir Henry Maybury, Director-General of Roads, said in 1926 that we had then something like 100,000 miles of highways which had yet to be improved, and a large percentage of that 100,000 miles had never been surfaced with a really good material.

A general speeding-up of motor traffic will come,

assuredly, as road improvement proceeds. Motor cycles are advertised with guaranteed speeds of 50 miles an hour. Will the "flapper-bracket" be still in vogue when the motor cycle manufacturers are able to offer road machines with twice that speed? A motor car was able to cover a mile at a speed of 150 miles an hour for the first time in 1926, when Capt. Malcolm Campbell wrested the world's record from Italy in his giant 350-h.p. Sunbeam racing car on Pendine sands, in Carmarthenshire. The Italian record for the mile was 145·90 miles an hour; Capt. Malcolm lowered this to 150·766 miles an hour.

The motor has been literally to the ends of the earth; Amundsen's airship *Norge* hung over the North Pole. But over the first attempt to make use of motor transport in polar exploration there hangs the shadow of a great tragedy. Captain Scott, when making his preparations for his expedition for the discovery of the South Pole—the quest which was to succeed at the cost of his life and the lives of his four brave companions—had motor sledges built to assist in the work of transporting the explorers' necessities over the Antarctic snows and ice. Marvels of man's genius were these sledges, and Captain Scott was hopeful that they would be of enormous assistance to him and to his companions. At a trial held in Norway before the expedition started, the sledges proved equal to accomplishing a speed of 5 miles an hour over the snow, while dragging a weight of about 1 ton.

Alas! The relentless South was not to be conquered by the motor at its first assault. True, the South

Pole was discovered, but the motor seems to have played merely an inglorious part in the discovery. That the sledges were not a great success is patent. In the reports telegraphed from New Zealand on the return of the *Terra Nova* with the tragic tidings, two references were made to the motor sledges. The first reported that when Captain Scott began his advance to the south he dispatched two motor sledges dragging fuel and fodder. It is related that the rest of the party followed the tracks of the motors for 60 miles on the road to One Ton Camp (11 miles from which Scott died on the homeward journey), and then found the machines abandoned because of the overheating of the air-cooled engines. It seems a strange fate to have overtaken them in the Antarctic!

The view expressed in these telegraphed reports was fully borne out by Commander Evans, who succeeded Captain Scott as commander of the expedition. Commander Evans, in a lecture before the Royal Geographical Society on 21st May, 1913, when he told the full story of the voyage and its great tragedy, made two references to the motor sledges. Relating the story of the landing at Cape Evans in January, 1911, he said: "Captain Scott, Wilson, and myself went across the ice and visited a little cape which looked and subsequently proved to be an ideal spot for wintering. This place Captain Scott named Cape Evans. Immediately the winter quarters were selected, out came the stores and transport. Lieutenant Pennell took charge of the ship and Lieutenant Campbell the transport over a mile and a half of sea ice. Mears's dogs, Oates's ponies and Day's motors, supplemented

by the man-hauling apparatus, passed between the ship and the shore transporting the stores over the frozen sea." At the beginning, at any rate, the motors appear to have caused no trouble.

The trouble was to come on the final advance. This is Commander Evans's narrative of their last effort: "On October 24th (1911) the advance guard of the southern party, consisting of Day, Lashley, Hooper, and myself, left winter quarters with two motor sledges. We had with us three tons of stores carried on six sledges. The object of sending forward such a weight of provisions was to save the ponies' legs over the variable sea ice, which was in some places hummocky and in others too slippery to stand upon. The first thirty miles of the barrier was known to be bad travelling. The motor party had rather trying experiences owing to the frequent overheating of the air-cooled engines. Directly the engines became too hot they refused duty and we had to stop; and by the time they were reasonably cooled the carburettors had to be warmed up with a blow lamp. Day and Lashley, the engineers, had great trouble in starting the motor sledges. It is true that the motors advanced necessaries for a southern journey 51 miles, but at the expense of the men who had charge of them. The engineers continually got their fingers frost-bitten tinkering with the engines and replacing the big-end brasses, which several times gave out. Although the temperatures were low we were all very happy, and Day was most keen to bring the motors through with credit. They were abandoned a mile south of Corner Camp; but they had advanced their weights in turn

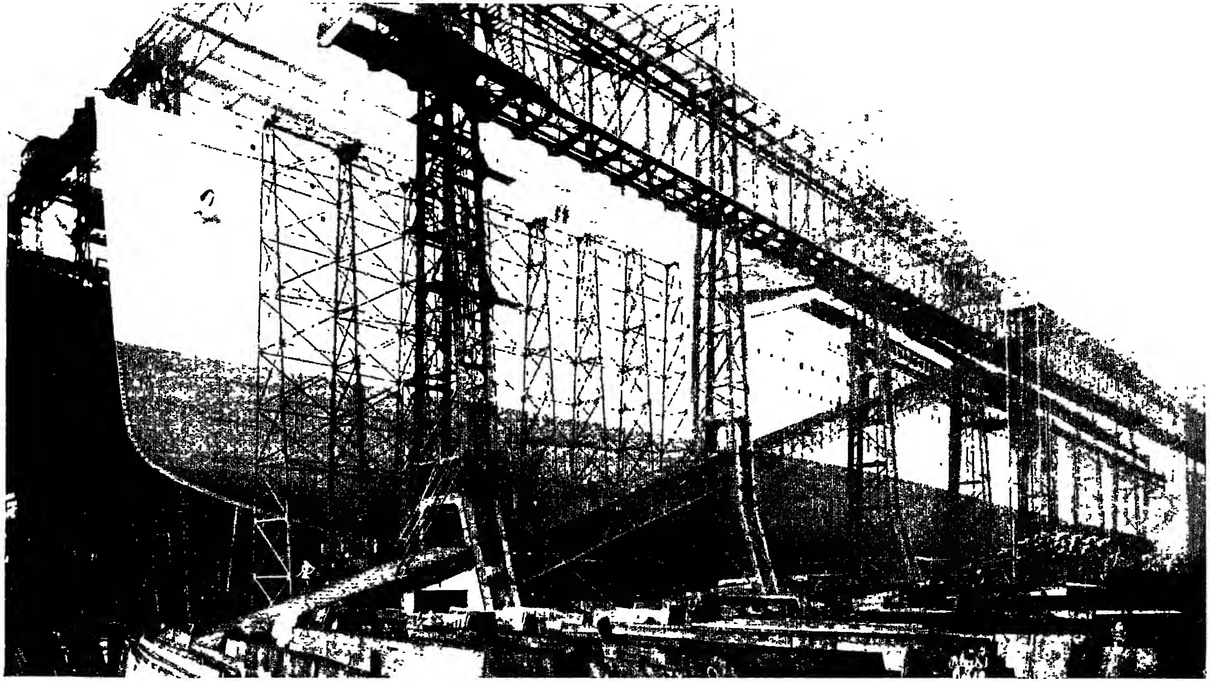

Photo Welch

THE R.M.S. *OLYMPIC* ON THE STOCKS

This view gives a good idea of the huge size of the modern Atlantic liner, and shows also the elaborate nature of the scaffolding required in her construction.

Chap VIII

over rough, slippery, and crevassed ice and had thus given the ponies a chance to march light. The first thirty miles of barrier surface led over very deep soft snow, and in fairness to the despised motors they went better over the soft snow than any other part of our transport."

So the motor has been very nearly to the "ends of the earth", but it has yet to retrieve its character in Polar regions. That its first journey in so forbidding a land should not have been crowned with great success is no dishonour to the motor. It is not, after all, so very many years ago since numerous first efforts to reach Brighton from London were ignominious failures! Failures should at any rate be regarded as stepping-stones to success. The motor builder and the motorist have profited greatly by the early setbacks, and doubtless the lesson of the Antarctic will not be neglected when there is a call for more motor sledges. And meanwhile the self-propelled vehicle will proceed upon its triumphant way—a friend to the rich and to the poor; an aid to pleasure and an indispensable adjunct to commerce; useful in peace and formidable in war.

CHAPTER VI

Sea Transport in Ancient Times

So far we have dealt with overland transport only, but, as the geography books tell us, for every square mile of land surface the world has about 2½ square miles of water surface; and it is plain, therefore, that if we had to rely upon land transport only, our communications with other countries would be sadly restricted. As a matter of fact, water transport has been linked with land transport from the remotest historical times. Perhaps you think that the first ship of which there is any record was Noah's Ark. If so, you are a few thousand years wrong. Sir George Holmes, in the handbook to *Ancient and Modern Ships* published by the Board of Education, states that "there are vessels now in existence in Egypt which were built about this very period"—that is to say the period (2400 B.C.) assigned in the marginal references of the Bible to the building of the Ark. Indeed, as Sir George goes on to point out, the enormous size of the Ark indicates that at the time of its construction the art of shipbuilding had reached a highly advanced stage of progress. In what quarter of the globe that art had its origin —in what waters man first advanced from the raft

or the dug-out canoe to the built-up vessel—it is mpossible to say.

For all we know to the contrary, the distinction of building the first ship may be due to the dwellers upon the shores of the Atlantic, or the Indian or the Pacific Ocean. All we can say is, that so far as the countries bordering upon the Mediterranean are concerned, everything seems to point to the Nile valley as the birthplace of naval architecture. "In the first place," says Sir George Holmes, "the country was admirably suited, geographically, for the encouragement of the art of navigation, having seaboards on two important inland seas which commanded the commerce of Europe and Asia. In the next place, the habitable portion of Egypt consisted of a long narrow strip of densely peopled fertile territory bordering a great navigable river, which formed a magnificent highway throughout the whole extent of the country. It is impossible to conceive of physical circumstances more conducive to the discovery and development of the arts of building and navigating floating structures. The experience gained on the safe waters of the Nile would be the best preparation for taking the bolder step of venturing in the open seas. The character of the two inland seas which form the northern and eastern frontiers of Egypt was such as to favour to the greatest extent the spirit of adventure. As a rule their waters are relatively calm, and the distances to be traversed to reach other lands are inconsiderable. We know that the ancient Egyptians, at a period which most modern authorities place at about 7000 years ago,

had already attained to a very remarkable degree of civilization and to a knowledge of the arts of construction on land which has never since been excelled. What is more natural than to suppose that the genius and science which enabled them to build the Pyramids and their vast temples and palaces, to construct huge works for the regulation of the Nile, and to quarry, work into shape, and move into place blocks of granite weighing in some cases several hundreds of tons, should also lead them to excel in the art of building ships?"

Fortunately for our knowledge of these wonderful people, they lived in a climate so dry that the pictures with which they decorated their tombs and temples have remained almost as fresh as when they were painted or sculptured thousands of years ago. In many of the tombs, models as well as drawings of boats have been found, together with descriptive accounts of the uses to which they were put. They constitute, in fact, a sort of Illustrated Egyptian News which brings home to us across many tens of centuries the habits and customs of nations that have long since disappeared.

The earliest vessels of which any particulars have come down to us are supposed to have been built between 5000 and 6000 years before the Christian era by the people who inhabited Egypt before the coming of the builders of the Pyramids. Some of the representations of these early vessels are so rude that I do not think you would recognize them as boats. But for the birds which the artist has represented as flying over or resting upon them, you might

take them at first glance for scrubbing brushes. Recent discoveries of larger drawings of similar objects show, however, that the things which look like the bristles of scrubbing brushes are intended for oars; and the fact that specimens of pottery from the eastern shores of the Adriatic were also discovered in the tombs in which these pictures were found, seems to prove that 7000 years ago boats were used, not only for river traffic, but for sea voyages of considerable length.

The Egyptians—that is to say, the people who inhabited Egypt after the builders of the boats just described—were either much better boatbuilders or much better artists than their predecessors, for their pictures of boats are not to be mistaken for anything else. The earliest known representation of an Egyptian boat is supposed to be about 6300 years old—that is to say, nearly 2000 years older than the date assigned to the building of Noah's Ark. This was a shapely vessel, something like a large gondola, propelled by paddles. The boat was wholly or partly decked, so that the paddlers squatted on their haunches flush with the gunwale. At the bow stood a man with a sounding pole, ready to give warning of shoal water or to shove the boat's head away from rocks; and at the stern stood three steersmen, with paddles rather larger than those used for propelling the boat. Amidships stood an officer with a formidable whip in his hand. This was the lever with which the marine engineer of those days was accustomed to put on more steam, and I am afraid that the ancient Egyptian equivalent for "an extra

knot" had a very painful meaning for the seamen of the time.

The most interesting points about this boat, however, are, first, that it was apparently 50 or 60 feet long, and must therefore have been no mere dug-out, but a scientifically built-up boat; and secondly, that it carried a mast, thus proving some knowledge of sailing even at this early date. The mast is a triangle, being shaped like the letter A, with a wooden cross-piece in the middle. It is represented as unshipped, and resting horizontally upon the roof of a sort of cabin. In boats of a rather later period we find masts with three legs, from which it would appear that there is no novelty in the tripod masts of our battleships. The sail, as appears from other drawings, was a square sail set upon a yard, the braces of which were held by a man sitting in the stern of the boat. Herodotus tells us that in his time (450 B.C.) the sails of the Egyptian Nile boats were made of papyrus—rather a curious fact, considering that the Egyptians not only manufactured linen, but actually exported it to other Mediterranean countries for use as sailcloth. The same historian describes how the boats were steered downstream with a stone dragging astern upon the bottom of the river. You may see this method practised nowadays in our English estuaries when there is no wind, by fishermen who have never heard of Herodotus; only, instead of a stone they use a kedge or anchor, towing it in such a way that its crown just touches the bottom. Their object, like that of the ancient Egyptian navigators, is to prevent the boat from drifting at the

same rate as the stream, for if it did so it would not steer.

Enormous blocks of granite were conveyed by water from the quarries at Assouan for the building of pyramids and temples. In the Great Pyramid, nearly 600 miles below Assouan, there are some blocks weighing 50 or 60 tons which were thus transported, but these are trifles compared with some of the cargoes handled by the Egyptian boatmen. In the Temple of Der-el-Bahari has been found an illustrated account of the shipment of two obelisks which are supposed to have weighed together about 700 tons, and the sculptured pictures show that the barges designed for their transport were stayed and trussed with beams in a thoroughly scientific manner. These barges were each steered by two pairs of great oars or sweeps, slung by ropes from the stem of the vessel.

Coming to ocean as distinct from inland transport, the earliest oversea expedition recorded in the world's history took place about the time assigned to the building of Noah's Ark. It was an expedition from Egypt to the land of Punt, supposed to be the country now known as Somaliland, and its object was "to fetch for Pharaoh sweet-smelling spices". The enterprise was under the command of an officer named Hannu, whose account of it has been translated from the original hieroglyphics and published by Dr. Henry Brugsch.[1] After describing his preparations Hannu says:—

"I arrived at the port Seba, and I had ships of burthen built to bring back products of all kinds.

[1] *History of Egypt under the Pharaohs.*

And I offered a great sacrifice of oxen, cows and goats. And when I returned I had executed the King's command, for I brought him back all kinds of products which I had met with in the parts of the Holy Land (Punt)."

Hannu winds up his narrative by declaring that the like of such a thing had never been done before. We can fancy what airs he would give himself upon his return, and how he would be fêted and lionized as the man who had sailed "farthest south".

We have a fuller account of another voyage to Punt which took place about 1600 B.C., at the time when the Israelites were in captivity in Egypt. From one of the inscriptions quoted by Dr. Henry Brugsch it appears that the voyagers brought back with them a cargo which may properly be described as "mixed".

"The ships were laden to the uttermost with the wonderful products of the land of Punt, and with the different precious woods of the divine land, and with heaps of the resin of incense, with fresh incense trees, with ebony, (objects) of ivory set in pure gold from the land of Amu, with sweet woods, Khesit wood, with Ahem incense, holy resin, and paint for the eyes, with dog-headed apes, with long-tailed monkeys and greyhounds, with leopard skins, and with natives of the country together with their children."

The historian concludes by asserting that the like had never been done before. Hannu, you will remember, had made the same boast about eight hundred years earlier. It seems to have been regarded as the proper way of polishing off every story of Egyptian enterprise.

The ships used at the time of this great Punt expedition were very much larger and more powerful than the river-boat with paddlers previously described. They were propelled in calms and adverse winds by fifteen pairs of oars, and they carried very large square-sails with yards both at head and foot, so slung from the mast that they could be braced at any angle. The sailing capabilities of these vessels, therefore, were not limited to running dead before the wind; yet they could not have sailed very much off it without drifting rapidly to leeward, owing to the absence of keels or leeboards. They had very long overhangs fore and aft, and their form, as well as the great size of their steering paddles, suggests that the two helmsmen must have had all their work cut out for them to keep a straight course when running before a stiff breeze. Not the least interesting point about these vessels is the method by which the overhanging ends were supported. This was accomplished by putting a stout sling round each end and connecting the slings by a rope which was tautened with upright props, much in the same way that a fiddlestring is tautened by the bridge of the fiddle. Without this precaution the leverage of the overhanging ends would have tended to buckle up the vessel amidships.

A few hundred years after the second Punt expedition two other maritime nations appear upon the misty horizon of history. We come to the Homeric Age, when Hellas

> "launched a thousand ships
> Against the topless towers of Ilium".

These ships, as described in Homer, were undecked vessels large enough to carry 120 warriors, but light enough to be drawn up on land. They were propelled chiefly by rowers who sat on benches, but they carried a mast and square-sail. The mast could be shipped and unshipped at pleasure, and when up was supported by rope stays fore and aft. In the *Odyssey* is a detailed description of the building by Ulysses of another sort of boat, apparently a flat-bottomed craft with a mast and yard and sail. The sides of the boat were fitted with a bulwark of wicker-work "to breast the dashings of the angry tide".

About this time a very remarkable position in the commerce of the world was occupied by the Phœnicians, who inhabited a narrow strip of country on the coast of Palestine. They are supposed to have come to the Mediterranean from the shores of the Persian Gulf, but whatever their origin, they showed an extraordinary aptitude for trade and navigation. Their chief ports were Tyre and Sidon, and in these cities the overland commerce of the East met the seaborne commerce of the West. The earliest reference in the Bible to oversea navigation concerns the second of these two cities: "Zebulun shall dwell at the haven of the sea; and he shall be for an haven of ships; and his border shall be unto Zidon" (*Genesis*, xlix. 13): and in *Ezekiel* there is a denunciation of Tyre which gives us a wonderfully vivid picture of the extent and value of Phœnician trade. In Chapter III I referred you to this passage (*Ezekiel*, xxvii) for information as to the commodities which were dealt in by the merchants of those days. Let us turn

to it again, to read of the fame of the port of Tyre:—

"O thou that art situate at the entry of the sea, which art a merchant of the people for many isles. . . . O Tyrus, thou hast said I am of perfect beauty. Thy borders are in the midst of the seas, thy builders have perfected thy beauty. They have made all thy ship boards of fir trees of Senir: they have taken cedars from Lebanon to make masts for thee. Of the oaks of Bashan have they made thine oars; the company of the Ashurites have made thy benches of ivory, brought out of the isles of Chittim. Fine linen with broidered work from Egypt was that which thou spreadest forth to be thy sail. . . . The inhabitants of Zidon and Arvad were thy mariners; thy wise men, O Tyrus, that were in thee, were thy pilots. The ancients of Gebal and the wise men thereof were in thee thy calkers; all the ships of the sea with their mariners were in thee to occupy thy merchandise."

This passage, even if we had no other evidence, would show that the Phœnicians in Ezekiel's day sailed far and wide across the seas. They traded with Cyprus and Rhodes, with Greece, Italy, and the northern shores of Africa, where they founded the colony of Carthage, and with Spain, where they founded Cadiz. They traded, indeed, with every part of the world that was known to them and to their neighbours, and to at least one part that was known only to themselves; for some of their adventurous captains, sailing over stormy seas far beyond the Pillars of Hercules,[1] discovered a northern country

[1] i.e. the Strait of Gibraltar.

where the valuable metal, tin, was to be obtained. The Phœnicians kept its whereabouts a secret, and refused to allow the vessels of other nations to sail in company with theirs, lest they too should discover the mineral wealth of Britain.

The Phœnicians not only traded on their own account; they lent ships and seamen to other nations. There is some reason for believing that in the service of King Solomon they sailed as far east as India. Herodotus tells us that about the year 600 B.C. they circumnavigated the African continent. He tells us that Neco, the reigning Pharaoh of Egypt, began to cut a canal through the Isthmus of Suez, but, finding the task too great, abandoned it. He was convinced, however, that the continent, except for the isthmus, was surrounded by sea, and to prove it he engaged some Phœnicians to sail round from the Red Sea to the Mediterranean. The voyagers proceeded in a very leisurely way, sailing only in the summertime. When autumn came, they went ashore, sowed wheat, and made themselves as comfortable as they could until it ripened. Then they loaded the grain into the ships and sailed on until it was time to sow another crop. In this way they took more than two years to sail round the Cape into the Mediterranean, but it was a very remarkable accomplishment nevertheless. "They told me," says Herodotus, "what I for my part cannot believe, that when they were sailing round they had the sun on their right hand." What the old historian could not believe is really the best evidence that his tale is true, for south of the Equator, as you know, one sees the sun to the

north, and it rises therefore on the right hand of the observer instead of on the left, as in our northern latitudes.

The Phœnician navy formed part of the immense fleet of Xerxes, numbering, it is said, 4200 vessels, which was defeated by the united Greek fleet at the ever-memorable battle of Salamis, about 480 B.C. But it is with commerce that we are dealing, and not war. I shall therefore pass over the war fleets and the sea fights of the ancient nations, and try to tell you something about their voyages of trade and discovery.

There was a marked difference, even in the days of the Phœnicians, between the warships and the merchant ships. While the warships of the Mediterranean until the sixteenth century of our era were galleys propelled mainly by oars, the merchantmen were built for sailing, and were broader and deeper than the galleys. The stem and stern posts of these vessels rose to a considerable height, the stem ending in a figurehead representing the arched neck of a goose or swan, and the stern in a fan-shaped ornament, which was often turned inwards so as to screen the helmsman from sun and rain. The sail was carried on a yard as long as or longer than the vessel's deck, and at the top of the mast there was a cup-shaped crow's-nest for the lookout man. Sometimes a foremast was carried, raking over the prow, to support a storm sail in bad weather. The steering was effected by two large oars, resting on notches in the gunwale and secured by a thong, or, in larger vessels, working through stern ports which could

be used as hawse-holes when the steering oars were unshipped.

It was doubtless in such ships as these that the Carthaginians, who succeeded the Phœnicians of Tyre as the masters of the Sea, traded to Gaul and Britain, to the Canaries and to Guinea. About the year 500 B.C., a hundred years or so after the Phœnicians had circumnavigated Africa, Hanno the Carthaginian undertook a colonizing expedition to the West Coast with sixty ships. We have a very full description of his adventures, including the discovery of "a savage people with hairy bodies, whom the interpreters called gorillas". He evidently thought these monstrous apes were human beings, but that did not prevent him from killing one of them in order that he might bring home the skin as a trophy.

It was from Carthage that the Romans learnt most of what they knew about shipbuilding and navigation, and after the destruction of that city there was no marked alteration in Mediterranean ships for many centuries. The vessels were sometimes of considerable size, and were capable of keeping the sea in severe weather; but they seldom sailed abroad in winter, chiefly perhaps for the reason that they were steered by the stars, and that clear skies were therefore necessary for safe navigation. The ship in which St. Paul was wrecked carried 276 persons and a cargo of grain. The great Apostle evidently knew a good deal about sailing, and his graphic narrative of the voyage, as given in *Acts*, xxvii, throws a deeply interesting light upon the seamanship of ancient times.

St. Paul's account shows us that at the opening of the Christian era the arts of shipbuilding and navigation, which, as we know, had been progressing for many centuries previously, had attained a high degree of development in the Mediterranean. Now let us turn to the north, and see what the inhabitants of Britain had been doing in this direction. As dwellers in an island with many natural harbours and sheltered estuaries, and abundantly supplied with the materials for shipbuilding, we might perhaps expect to find them at least as far advanced in the maritime arts as the people of Italy, Greece, or Northern Africa. In truth they were far behind. Eight years before St. Paul was shipwrecked at Malta, Julius Cæsar had crossed from Gaul to Britain, and had lifted the veil which up to that time had shrouded from the civilized world of Rome the habits and customs of these distant islanders. According to Cæsar, the British boats were mere coracles of wicker-work covered with skins, and the British seamen, if seamen they can be called, never tasted food upon a voyage—proof that their longest voyages could not have extended over many hours. The backwardness of the Britons in maritime progress is the more remarkable when we remember that for centuries Phœnician and Carthaginian ships had been visiting British ports, and that their neighbours and allies the Veneti, who dwelt on the north-western coast of Gaul, where they have left their name in the modern Vannes, are credited by Cæsar with a decided aptitude both for boat-building and for boat-sailing.

Before the Roman invasion British commerce was

a thing almost unknown. A people who were content to clothe themselves in skins and paint and to live in draughty huts of sticks and straw were not likely customers for luxuries from abroad. The Romans gave a different aspect to the scene. Their legionaries sighed for the comforts of civilization. They connected their inland camps with the coast by excellent roads. They made harbours and lighthouses, and for the next 300 years or so the Roman ships sailed into Dover, and up the Thames to London, bringing the good things of Italy and Gaul, and taking back with them the natural products of Britain.

In course of time, Rome, hard pressed elsewhere, withdrew her legions, and left the shores and shipping of Britain to the tender mercies of the Saxon corsair, "whose pastime it is" (says a contemporary historian) "to plough the British Sea in a boat made of skins and stitched together". They were daring seamen, those Saxons: "tempests, which to others are so dreadful, to them are subjects of joy; the storm is their protection when they are pressed by the enemy, and a cover for their operations when they meditate an attack". After their conquest of England they seem, however, to have neglected the maritime arts, and to have suffered the ravages of the Danes or Northmen without any effective resistance until the great King Alfred's time.

These Northmen were called Vikings, a word which means Sons of the Fiord, because they came from the creeks of Norway and Denmark. They were very brave and very cruel, and they were just as much at

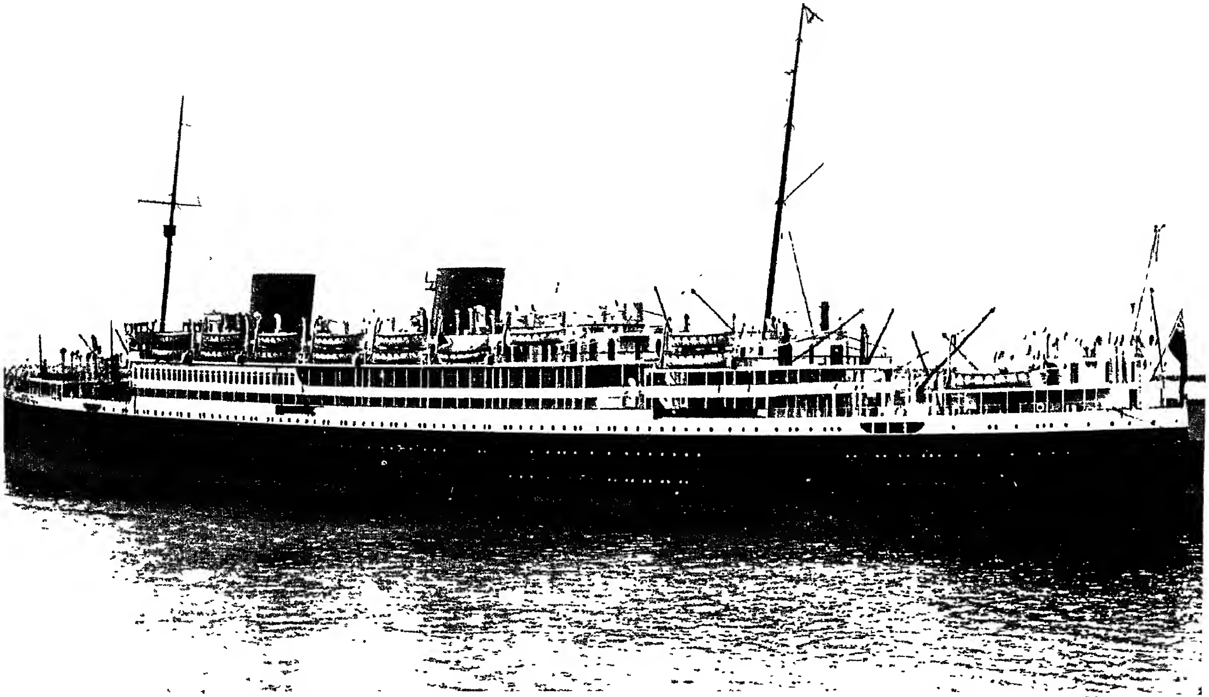

Photo. Topical

ROYAL MAIL STEAM PACKET CO.'S MOTOR SHIP *ASTURIAS*

Of 22,500 gross tons, and 20,000 h.p., she is the most powerful motor vessel in the world (1927)

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home upon the sea as upon the land. If all the tales told of them are true they must have been acrobats as well as sailors, for it is related of one of them that he could run along the oars as they were flashing in the water, and could perform the juggler's trick of keeping three javelins in the air at the same time, throwing them as high as the masthead and catching them as they fell. We know exactly what their boats were like, because when a great Viking died his boat was buried with him, and some of these boats have been dug up in recent times and placed in museums. They were propelled mainly by oars, but they carried also a mast and square-sail. The ropes were made from the bark of trees[1]; the sails, perhaps, were of leather, like those of Cæsar's friends the Veneti. The steering was done with one short oar or steering board on the starboard (steerboard) side. The boats were models of lightness and strength, well suited for the swift and sudden raids which made the name of the Northmen so greatly feared. They do not seem to have been so well fitted for long voyages, but we know that their terrible owners overran at one time or another the whole of the European seaboard. They found their way into the Mediterranean, they discovered and colonized Iceland, and there is some reason to believe that they discovered America 500 years before Columbus. They cruelly harried the coasts of Saxon England, delighting to raid the villages, murder men, women, and children, and carry

[1] Most modern vessels carry bass warps,—rough ropes made from the bast or inner bark of the lime tree. A bast fibre frequently has a breaking point higher than that of steel.

off what plunder they could find. The Saxons, when they caught a Northman, retaliated by flaying him alive and nailing his skin to the church door. But this was not often, for the Northmen had things nearly all their own way until King Alfred built bigger and better vessels than theirs, and thus laid the foundations of a British navy.

If every Saxon king who followed Alfred had given as much thought to the navy as he did, there would have been no Norman invasion, and William I would have failed to earn his title of the Conqueror. Harold had ships, indeed, but did not use them, and William was so little afraid of them that he brought his army across the Channel in an unprotected fleet of about 1000 small vessels, which he burnt as soon as he had landed in Sussex. A hundred ships manned by the seamen of Alfred's day might have sent the would-be conqueror and half his knights to the bottom; but whether that would have been a good thing for you and me and for England is a question which is rather too difficult to answer. We have pictures of the Norman ships in the Bayeux Tapestry, and very fine they must have looked with their coloured sails and carved figureheads. It seems a pity to have burnt them, and perhaps the Conqueror himself thought so when the Danes began their attacks again and he was obliged to build a new navy.

But now, having seen William and his knights across the English Channel, we must glance again at the Mediterranean, whose powers are still competing for the commerce of the inland sea. Chief of them is Venice, "the Queen of the Adriatic", which at the

time I am speaking of, and for long afterwards, was the greatest maritime power in Europe. Thirty years after the Norman Conquest Godfrey of Bouillon led the first of the great Crusades into the Holy Land. This expedition, and the many similar expeditions which during the next 200 years succeeded it, helped greatly to bring Venice to the pinnacle of her naval fame; for she and her sister states alone among European powers had ships enough to transport the troops and horses and stores to the battlefields of the Cross. The Crusades made the fortunes of the shipowners and merchants of Venice and of the rival republic of Genoa. They also gave a great increase to the trade of England and the other countries which took part in them. Some of the Crusaders' own ships generally accompanied the vessels which they hired in the Mediterranean, and thus their mariners learnt their way into seas that were new to them, and had their eyes opened to the extent of the Eastern trade.

We have a quaint account of the voyage of an English fleet from Dartmouth to Marseilles, where it was to pick up Richard Cœur de Lion, who had prudently gone by land. The fleet was under the command of two bishops and three knights, and notwithstanding the unseamanlike callings of its admirals it got along fairly well until it reached the Bay of Biscay, where a great storm arose. Some of the ships nearly foundered, but fortunately the bishops and knights were not too seasick to cry aloud to St. Thomas of Canterbury. The ghost of À Becket, we are told, promptly came to the rescue, dressed in the robes which he had worn when an Archbishop on

earth, and promised to conduct the fleet direct to its destination. He seems, however, to have got out of his reckoning, for most of the Crusaders soon found themselves at Lisbon, where, I am sorry to say, "some naughty fellows among them fell to breaking and robbing of orchards, and some also, on entering the city, behaved themselves very disorderly". Worse things followed, and a good many heads were broken before the Crusaders rejoined their ships and continued their voyage to the Mediterranean.

The English ships at this period were little better than open boats with a single mast. It was not until the time of Richard III that English seaborne trade obtained a firm footing in the Mediterranean, and that English vessels attained anything like the form which we are accustomed to regard as "shipshape". Meanwhile it was left, as we shall see in the next chapter, to the adventurous seamen of other nations to discover new worlds and new openings for trade.

CHAPTER VII

The Discovery of the World's Sea Roads

If you turn to the map of Europe in your atlas, you will probably find that the draughtsman has included within its borders the southern and eastern shores of the Mediterranean—which, as you know, are not in Europe—and also a small piece of Greenland. With these inclusions the map roughly represents as much of the world as was known to European navigators at the beginning of the reign of Henry VII—that is, about 430 years ago. Geographers and merchants knew that far to the east of Europe were India and Cathay (China), whence came gold and silks and spices and precious stones; a few—a very few—European travellers—among them the Venetian, Marco Polo—had visited these distant countries; but the trade and the travellers passed overland through Egypt to the Red Sea, or through Syria to the Persian Gulf. No European ships had repeated the feat, said to have been accomplished by Phœnician sailors 2000 years earlier, of doubling the African Cape, or that attributed to the Norsemen, of crossing the Atlantic. A few Portuguese adventurers had begun to explore the West Coast of Africa, but had

not yet ventured as far as the Equator. The southern extent of the African continent was an unsolved riddle; the existence of the great transatlantic continent was undreamt of.

You see how small was the seaman's world in the middle of the fifteenth century. Its smallness is the more surprising because for a hundred years or so European navigators had carried in their ships two things which must have greatly increased their confidence. One of these things was the compass, which enabled them to steer without the stars; the other was gunpowder, which gave them security against the attacks of any hostile savages upon whose shores they might land. Nevertheless there seems to have been at this time little inclination for maritime exploration except in one corner of Europe, where a man arose whose enterprise was destined to have a marked effect upon the seaborne commerce of the world. The man was Prince Henry the Navigator, fifth son of King John I of Portugal and a grandson of our John of Gaunt. Prince Henry died in 1460, some years before the seamen whom he instructed and encouraged had ventured to carry their voyages as far south even as the Equator; but he had fired in their hearts an ambition which lived long after him, and in course of time spread to the seamen of other nations, and opened the glorious age of discovery associated with the names of da Gama, Columbus, and Magellan. When Prince Henry died, the limits of the world as known to European navigators were, as I have already said, about the same as those of the map of Europe in your atlas.

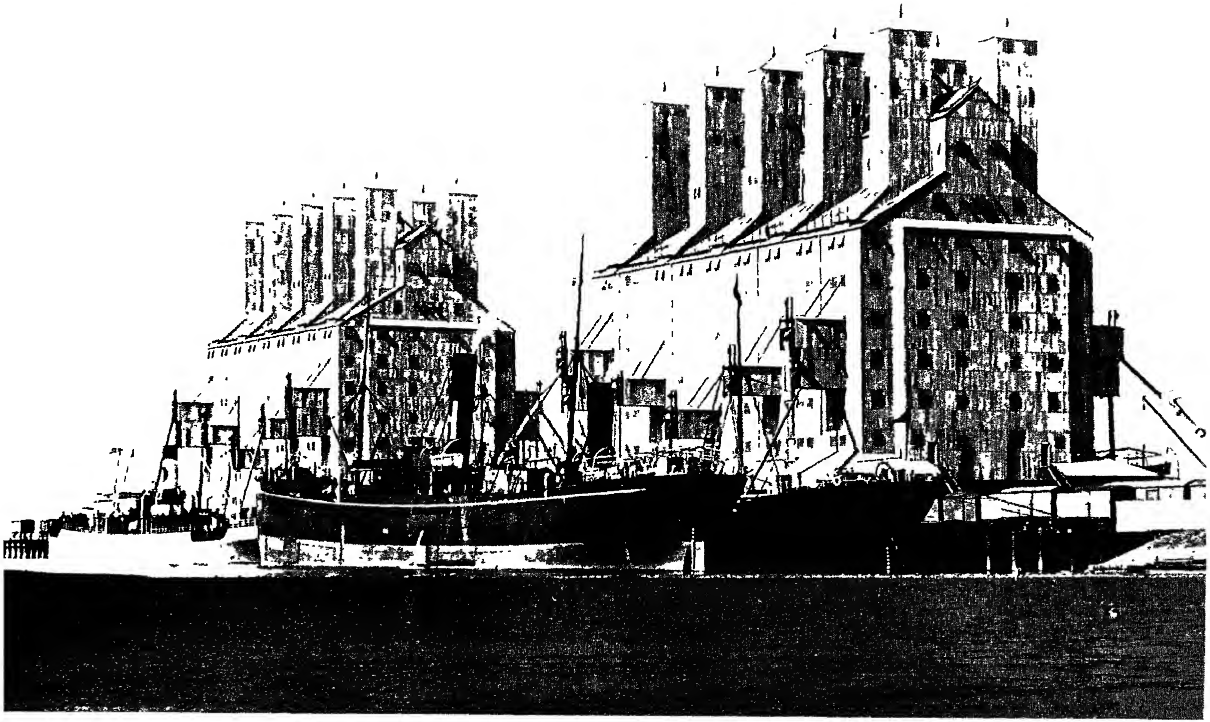
Twenty-six years later Diaz had doubled the Cape; in another six years Columbus had discovered America; six years later still, Vasco da Gama had sailed to India; and in twenty-two years more, one of Magellan's ships had completed the circumnavigation of the globe. In less than a hundred years after Prince Henry's death, almost all the world, as we know it now, had been outlined by explorers, and the merchant ships of Europe had sailed in all its seas.

You may wonder why the discoveries followed so rapidly one after the other; why maritime nations which had been content for many hundreds of years to potter about the Mediterranean and the European shores of the Atlantic should have been fired all at once with an ambition as large as the world itself. What was the lodestone that drew the early explorers east and west and round the globe? The answer is to be found in the trade of the East Indies, and in the growth of the conviction that the overland route was not the only one by which that trade could be conducted. From the days of Solomon, as we have seen, spices and silks had come from the East by way of Syria and Persia, but at the time of which we are now speaking this route had fallen into the hands of the Moors and other Mohammedans, and the trade was carried on with increasing difficulty.

Prince Henry the Navigator was bold enough to think that there might be another way, and he became at last so confident of finding one that he asked and obtained from the Pope a grant to Portugal of all the countries that he might discover by sailing south

and east. Summer after summer he sent forth the ablest and the boldest captains he could find, while he busied himself in improving the building of ships and the training of seamen, and in collecting maps and scientific observations. Every year his ships ventured a little farther. In 1420 they discovered Madeira, and Prince Henry then used this island as a starting-point for more distant voyages. But he found few of his countrymen to share his enthusiasm until twenty years later, when his captains, having ventured as far as the Guinea coast, began to bring back gold. The love of riches proved more powerful than the love of knowledge, and the nobles and rich merchants who had hitherto regarded Prince Henry's efforts with languid interest were now eager enough to have ships of their own upon the sea. Companies were formed, new fleets were built, forts and warehouses were established on the West Coast, and before Prince Henry died the Portuguese had become the leading maritime nation of the world.

In 1486, when Prince Henry had been dead for more than twenty years, and when John II was King of Portugal, interest in the discovery of a sea route to the Indies was revived by a strange story which came from Africa. Some natives of Benin, a territory on the West Coast, had told the Portuguese traders that far in the interior there reigned a great Christian king. Now from the time of the Crusades it had been widely believed in Europe that somewhere in the East there was a wonderful country ruled by a Christian monarch called Prester John, or John the Priest. The Christian king spoken of



GRAIN ELEVATORS, INGENIERO WHITE, BAHIA BLANCA

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by the Benin natives was said to reign in Africa; Prester John, according to all accounts, reigned in Asia; but who could say where Africa ended and Asia began? Might not the Christian kingdom of the African stories be the same as the Christian kingdom of the Asiatic stories? And in that case, might not India be much nearer to the Gold Coast and to Portugal than had been hitherto supposed? These questions occurred to King John of Portugal. The king, as his historian tells us, "considering that all spices, drugs, precious stones and other riches, which came from Venice, were brought from the East, and being a prince of great penetration and enterprise, desired to enlarge his kingdom and to spread the knowledge of the Christian faith to distant regions. He resolved, therefore, to discover the way by sea to the country from which such great riches came, that his subjects might thereby be enriched, and that his kingdom might possess those products which had hitherto been conveyed by way of Venice. He was greatly encouraged to this enterprise by learning that there were Christians in India, ruled by a great monarch called Prester John, to whom he wished to send ambassadors that friendship might be established between the two kingdoms."

King John accordingly fitted out three little ships —the largest was only 50 tons burden—and placed them under the command of Bartholomew Diaz. Diaz sailed down the West African coast as far as Angra Pequena. Here the coast line trends to the south-east, but a northerly gale springing up, the little ships were blown due south, out of sight of

land for thirteen days. They must have run thus for 600 miles or more, for when the storm abated and Diaz steered east to pick up the land again, he sailed 400 or 500 miles without finding it. Becoming anxious, he turned north and soon discovered why he had missed the land, for the coast now ran east and west. He had doubled the Cape, and, landing at Algoa Bay, he set up a cross to mark the first visit of a white man to South Africa. He would have liked to carry out the commands of his king, and to follow the coast line farther in the hope of discovering the Indies and Prester John, but his provisions began to fail, and his men prevailed upon him to return. So reluctantly he turned homewards, discovering on his way the Cape—not the most southerly, but the most prominent of the southern points of Africa. He called it the Cape of Storms. King John gave it a better name—the name by which we know it now—the Cape of Good Hope.

Among the seamen who sailed with Diaz to the Cape was a Genoese Italian named Bartholomew Columbus, whose younger brother Christopher was destined soon to achieve the greatest geographical discovery that ever was or ever can be made. Unlike his predecessors who had sailed along known coasts to discover what lay beyond, Christopher Columbus boldly left the land behind him with the conviction that he would find another land across the ocean, and he found it at the first attempt. The great merit of his discovery was that it was no mere accident, but the triumphant justification of a belief based

upon scientific knowledge. If, argued Columbus, the world is round, then India may be reached by sailing to the west. With this conviction he appealed to his own country, Genoa, to provide the means for an expedition. Rejected by the Genoese, he turned to Portugal, the land of his adoption; from Portugal he turned to England. Henry VII, who was King of England at this time, did much to encourage commerce and voyages of discovery, and it is said that but for the accidental miscarriage of a letter this country might have had the reward of Columbus's enterprise.

His offer was not, however, immediately accepted, and he turned from England to Spain. Here for a long time he urged his project in vain. All the learned men of Spain were against it. If, they said, in so many thousand years no land had been found to the westward, it was not likely to be found now or ever. The ocean was so vast that no ships could sail across it; and if any ship tried to do so the curvature of the globe would make it impossible for her to climb back again, even with a gale of wind behind her. Such were the arguments which poor Columbus had to answer, but he never lost heart. For seven years he urged his plan in the face of ignorance, apathy, and prejudice, and at last his perseverance was rewarded. He gained the ear of Isabella of Castile, and she and her husband King Ferdinand agreed to provide him with the ships he wanted. The fleet consisted of three vessels: the *Santa Maria*, commanded by Columbus, who was granted the title of Admiral; and two

smaller caravels, the *Pinta* and the *Nina*, commanded by the brothers Martin and Vicente Pinzon. The crews numbered about 100 men, and the ships were provisioned for a year.

On 3 August, 1492, the little fleet set out from Palos, a port on the southern coast of Spain, and steered south-west for the Canaries. On the second day out, the *Pinta's* rudder broke. It was temporarily patched up by Martin Pinzon, but two days later it again gave way. In consequence of these accidents and unfavourable winds they did not reach the Canaries until 12 August. Here nearly a month was spent in providing a new rudder for the *Pinta* and a new rig for the *Nina*, and on 6 September the adventurers began their voyage into the unknown. Not many of them, I am afraid, were in good spirits. Few of the seamen had joined the expedition with enthusiasm, and already every strange incident was regarded by the superstitious as an omen of coming disaster. The accidents to the *Pinta's* rudder, which Columbus strongly suspected to be no accidents, seemed to the ignorant seamen to be so many warnings against the voyage; and as they left the Canaries, a plainer and more terrible omen presented itself in the volcanic Peak of Teneriffe, which was shooting flame and smoke into the sky. "Many of the men", we are told, "began to weep and lament; but the admiral used every effort to comfort them with the assurance of soon finding the land he was in search of, and with the hope of acquiring wealth and honour by the discovery."

They were sailing now due west. What land was

Columbus in search of? Look at the map of the world, and imagine that the great American continent has sunk beneath the sea. Imagine that the Atlantic and Pacific Oceans are one. That was what Columbus supposed. He supposed that the other side of the Atlantic was bordered by India and Cathay (China), with an island called Cipango (Japan) between them. Fortunately for his enterprise he supposed the world to be much smaller than it is, but he meant to sail on until he found the Indian coast; and lest it should be farther than he supposed, and his men should grow alarmed at their distance from home, he practised a trick upon them. He kept two logs, one in which the real distance sailed each day was entered for his own guidance, the other in which a smaller distance was set down to mislead the timorous crew.

For eleven days they sailed over a calm sea with a fair wind, but the superstitious Spaniards found cause for anxiety even in the fine weather. It was a device of Satan, they said, to lure them on to destruction. What if the wind in these seas always blew from the east? How then would they ever be able to get home again! The very laws of nature were changing in these mysterious regions, for the compass no longer pointed, as it had done in Spain, to the North Star, but five or six degrees away from it. This last phenomenon, now familiar to every seaman as the variation of the compass, puzzled even Columbus. He did not know—the wisest men of those days did not know—that the world is itself a magnet, and that the magnetic poles towards which

the needle points are not the same as the geographical poles.

On 18 September Martin Pinzon, in the *Pinta*, reported that he had seen land, but Columbus felt sure that he was mistaken, and would not alter his course. On the 22nd the wind changed to the west, and although the change was unfavourable for his main object Columbus welcomed it, because he hoped it would satisfy the sailors that they would be able some day to sail back to Spain. It did not, however, stop them from grumbling. Why, they asked one another, should they risk their lives for the sake of a mad foreigner? Some of them even suggested that they should throw him into the sea, and return to Spain with the story that he had fallen overboard while gazing at the stars. Columbus knew of their discontent, and did his best, both by threats and by promises of reward, to keep them quiet; but he must have had a hard time of it. There were disappointments, too, in store. On 25 September Martin Pinzon, in the *Pinta*, working out the ship's course upon the chart, came to the conclusion that they must be nearing Cipango (Japan). Sailing close alongside the *Santa Maria*, he threw the chart to Columbus, and almost at the same instant caught sight of what he supposed to be land. Pointing to it, he shouted: "Land! land! Señor, I claim the reward!" Columbus looked, and falling on his knees, offered thanks to God, while the crews of all the vessels raised their voices in a hymn of praise. Alas! the supposed land was only a cloud.

Many similar disappointments followed in the next

few days, and the sailors became more gloomy than ever. On 7 October their spirits were somewhat revived by signs that land was not far distant. Field birds flew over their heads, and land weeds were seen floating in the water. But, as the hours passed and no land came in sight, the men grew desperate; and the admiral, we are told, "could not long have resisted the increasing clamour if it had not pleased God, on the afternoon of Thursday, October 11th, to show such manifest tokens of land that all began to take heart". A green rush floated past, and a cane curiously carved, and a branch newly broken from a tree. Pointing to these signs, Columbus bade his men give thanks to God for His great mercies, and told them that he expected to discover land before the next morning. At ten o'clock that night, as the admiral sat watching upon the poop, he thought he saw a light. The light was seen by others and more than once, and at two o'clock in the morning a gun from the *Pinta* gave the joyful signal that land was undoubtedly in sight. The little fleet was hove to, and waited impatiently for the dawn.

Daylight revealed an island, well wooded, and inhabited by people who crowded naked on the beach to welcome the voyagers, who they supposed had come from Heaven. In their grandest clothes, and carrying the royal standard of Ferdinand and Isabella, the admiral and his captains rowed ashore. Their first act, on landing, was to kneel down to thank God for having preserved them to make this great discovery. Then the seamen crowded round Columbus to express

their sorrow for the mutinous spirit they had shown during the latter part of the voyage. He freely forgave them, and having formally taken possession of the island, he named it San Salvador—the name which it bears to-day. The natives were friendly, and readily traded provisions and parrots and cotton yarn for red caps, glass beads, and other gaudy trifles. But Columbus did not stay long. Sailing farther west he discovered Cuba, San Domingo, and others of the West Indian islands, and then a succession of misfortunes compelled him to turn homewards. Martin Pinzon, hoping to be the first to carry the news of the discovery to Spain, deserted with the *Pinta*, the fastest of the three vessels. Then, by the carelessness of the seamen, the admiral's own ship, the *Santa Maria*, was wrecked. Only the *Nina* was left. Taking with him six of the West Indian natives, and specimens of the products of their countries, Columbus began his return voyage on 4 January, 1493, and after some perilous adventures arrived at Palos on 15 March. From Palos the voyagers went by land to Barcelona, to be received by Ferdinand and Isabella. The journey was a triumphal progress, culminating in the welcome at Barcelona, where the simple seaman was received by the King and Queen with all the honours reserved for a great noble.

Thus ended the voyage which, for the reasons I mentioned a few pages back, must be regarded as the most remarkable in the history of discovery. The *Santa Maria*, the largest of the three vessels, was only about as big as a Thames barge. She was

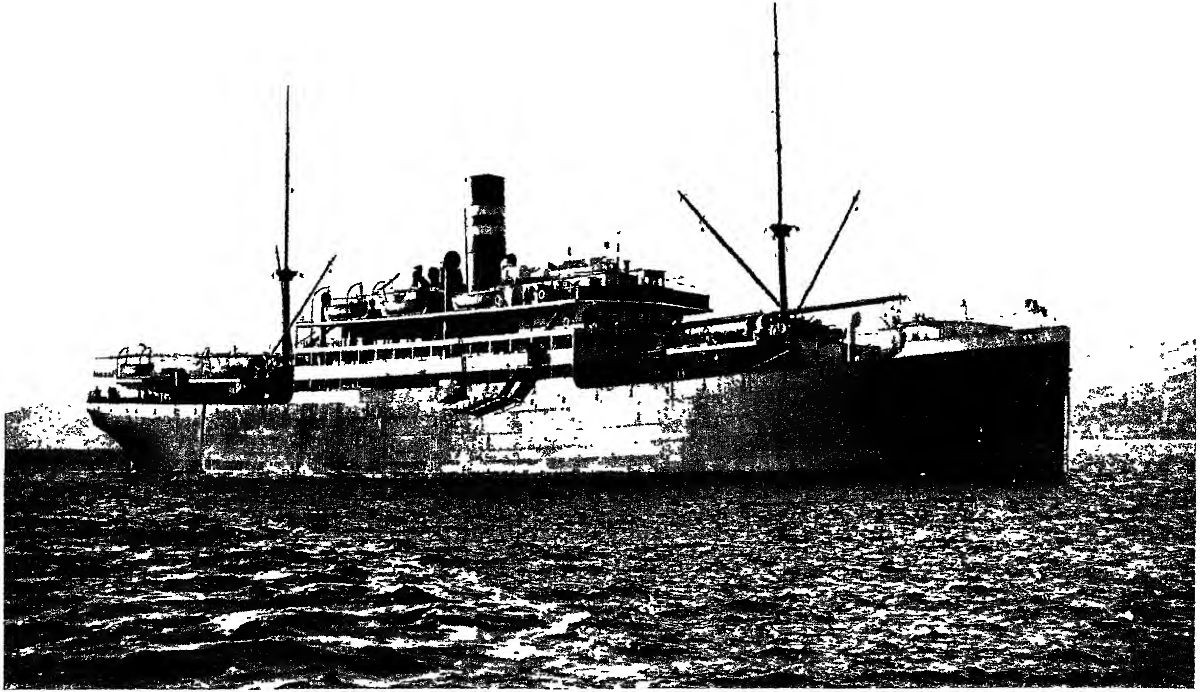

Photo Maclure, Macdonald, & Co.

THE NELSON LINER *HIGHLAND ROVER*—A MODERN REFRIGERATED-MEAT CARRIER

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128 feet long and 26 feet broad, and had an overhanging forecastle and an enormous poop. In the year 1893 the four-hundredth anniversary of this famous voyage was celebrated by building an exact copy of the admiral's vessel and sailing it from Spain to America with a Spanish captain and crew. The course followed was the same as that taken by Columbus, and the voyage occupied thirty-six days. The sailors could appreciate some, at least, of the trials of their ancient predecessors, for their quarters were uncomfortably cramped and the vessel pitched horribly.

Strictly speaking, Columbus was the discoverer, not of America, but of the West Indies. He did not land upon the American continent until his third voyage, in 1498. The first European to see, if not to set foot upon, that continent was John Cabot, the leader of an English expedition, who, sailing from Bristol in 1497, landed at Cape Breton, and coasted round the Gulf of St. Lawrence. Neither Columbus nor Cabot was aware that he had found a new world. Each of them thought that he had reached the Indian seas. Columbus believed that Cuba was Japan—the Cipango of Marco Polo. Cabot believed that Cape Breton was in the territory of the Grand Cham of Tartary, and that a passage to Cipango would be found to the south of it. The maritime nations, you must remember, were working for the same goal, namely India, where they thought all the precious things of the world came from. Pope Alexander VI, as I have already told you, had promised Portugal that she should have all the new countries that she

could discover by sailing east. He had also promised Spain that she should have all the new countries she could discover by sailing west. Each of these two kingdoms hoped to be the first to find the Indies, and by making them her own to become the richest country in Europe. Poor England, you see, was left out of account; but she had to be reckoned with later on, as we shall see: and in the meantime King Henry VII, disregarding the Pope's authority, gave to John Cabot, who like Columbus was of Genoese origin, a patent authorizing him to sail from Bristol into all seas, to seek out in any part of the undiscovered world islands and countries of the heathen hitherto unknown to Christians, to affix the banners of England in all places so found, and to subdue and occupy them for the English Crown.

Thus there were three eager competitors in the race for discovery, two of them working to the west and one to the east. You, with a modern map before you, can see at a glance that the Portuguese, the eastward voyagers, stood a much better chance than the English or the Spaniards of being the first to find the Indies. I think they deserved to be the first, because they had been seeking this goal ever since the days of Prince Henry the Navigator, while Spain and England had done little or nothing in maritime enterprise until the foreigners Columbus and Cabot came to stir them into effort.

In July, 1497, just as John Cabot was sailing into Bristol on his return from North America, a Portuguese squadron set out from Lisbon in the hope of

reaching India by way of the Cape of Good Hope. The squadron was commanded by Vasco da Gama, and consisted of three ships, the *San Gabriel*, the *San Raphael*, and the *Birrio*. The vessels were very much like the *Santa Maria* of Columbus, but were somewhat larger, and they were all rigged alike, so that in the event of accidents the tackle and gear should be interchangeable. They rounded the Cape, discovered eleven years earlier by Diaz, and sailed up the east coast, reaching Quilimane six months after their departure from Lisbon. After spending six months more in exploring the East African ports, they directed their course due east. In twenty-one days they sighted the Indian peninsula, and cast anchor at Calicut. The importance of this discovery of a sea route to India was greatly increased by the fact that about the time it was made the Sultans of Egypt completely cut off the trade which had been carried on for thousands of years between India and the Mediterranean by way of the Red Sea. The Cape route became the highway to the East, and remained so until the last century, when the reopening of the overland route, followed in a few years by the cutting of the Suez Canal, restored commerce to its ancient course.

Vasco da Gama's epoch-making discovery by no means checked the efforts of the explorers who hoped to reach India by sailing westward. Columbus and John Cabot died in the belief that they had discovered the borders of Asia. As the years passed, however, and the Spaniards explored the Atlantic coast of America without coming into touch with the

Portuguese, or finding any similarity between the native peoples of the country and those of India, the conviction was gradually forced upon them that the world was greater than they had supposed, and that between the West Indies and the East Indies lay a vast continent, and probably, for so the natives said, a vast sea.

At length, in 1513, the eastern shores of this sea were discovered by an adventurer named Vasco Nunez, who had fled from Spain to America to escape his creditors, and had appointed himself governor of the little Spanish colony of Darien, on the isthmus of Panama. A neighbouring chief made the Spaniards a present of gold, and while they were weighing it out they began to quarrel about shares. The chief's son stood scornfully watching the dispute until it threatened to come to blows, when, dashing his hand upon the scales and scattering the gold upon the ground, he asked them why they quarrelled about such a trifle. If they set such store by gold, why did they not go to the place where it was found in plenty? Over the mountains was a great sea, bearing ships manned by dark-skinned seamen, and beyond the sea was a country where people ate and drank from gold. Delighted with this news, Vasco hastened back to Darien, where he soon organized an expedition of 190 Spaniards, armed with swords, shields, crossbows, and arquebuses. He embarked this force in a brigantine and nine canoes, and sailed westward along the shore of the isthmus to the territory of a friendly chief who had promised him guides. Then the adventurers struck

inland towards the distant mountains, and after many perils and some stiff climbing they arrived, on 26 September, at the foot of a peak from the summit of which, the guides said, the sea was visible.

Ordering his companions to stay where they were, Vasco climbed the last 100 feet alone. Arrived at the top he gazed before him, and then, like a devout Spaniard, fell upon his knees and thanked God that he had been the first European to see the glorious sight, for there, miles away in the distance, lay the promised sea sparkling in the morning sunshine. Joyfully he beckoned to his companions to come up and share the prospect. "See, my sons," he said, "the object of our desire and the end of our labours; the ocean of which we have heard, and the promise of the lands which now we shall surely find and win. You shall yet be the richest Spaniards that ever came to the Indies." The little party chanted the *Te Deum*, and when this was ended they set to work to carve the name and arms of the King of Castile upon neighbouring trees, in order to show that they claimed possession of the land for their sovereign. Then they began to descend the mountain towards the ocean which they had seen. The journey took them four days. The first to reach the shore was one Alonzo Martin, who had been sent on with a small party in advance. Martin dragged down to the water a canoe which he found upon the beach, and, jumping into it, called upon his companions to witness that he was the first European to float upon that sea. Vasco Nunez and the rest of the company soon followed; and Vasco, running into the water

thigh-deep, and flourishing a shield in one hand and a sword in the other, proclaimed in a loud voice that he took possession of the newly found ocean for the Kings of Castile.

The news of the discovery of the South Sea was received with great joy in Spain, for it seemed to reopen the prospect of a westward route to the East Indies. The Portuguese had by this time a considerable trade with India by the eastward route, and had greatly excited the jealousy of Spain by extending their operations to the islands known as the Moluccas, of the wealth of which wonderful stories were brought back by the Portuguese seamen. The Spaniards believed that the Moluccas were situated in that half of the world which had been handed over to them by the Pope, and that they had only to reach them by the westward route in order to make good their claim. The newly discovered sea probably offered the way. The difficulty was to get ships upon it. Since it was impossible to drag ships over the mountains which Vasco Nunez and his men had climbed with difficulty, ships must be built upon the Pacific shore. But as soon as ships were built they were found to be rotten and useless owing to the ravages of a worm which infested those waters. Expeditions were then sent southwards along the Atlantic coast of America to search for a sea passage into the Pacific, but these efforts also failed. The prospect of finding an eastward route to the Moluccas seemed as far off as ever.

In this state of affairs there came forward a man who undertook to show the way. Fernando de

Magalhaens—Magellan, as we call him—was a Portuguese of noble family, a skilful seaman, a scholar, and an explorer of proved courage and endurance. He had visited India by the eastward route, and he felt sure that there was a way round by America. He asked the King of Portugal to lend him ships with which to find it, but the King of Portugal did not want it to be found. The Portuguese already had their own route, and they preferred to keep the Indies to themselves. The King had no desire to help Spain, so Magellan was dismissed with frowns and in disgrace. But he was not easily discouraged. He had married a Spanish lady, and so he carried his plans to the King of Spain. He took with him his friend Ruy Falero, a famous astronomer of the time, and between them they succeeded in persuading the King that they were trustworthy persons who knew what they were talking about. The King agreed to give them a fleet of five vessels—two of 120 tons, two of 90 tons, and one of 60 tons—to man the vessels with 236 Spanish seamen, and to furnish provisions for a voyage of two years.

On 20 September, 1519, Magellan's ever-famous voyage began. On that day his fleet set out from the port of San Lucar in Spain, steering for the Canaries. From the Canaries he skirted the coast of Africa to Sierra Leone, and thence laid a south-westerly course across the Atlantic to the beautiful harbour of Rio de Janeiro. Here the fleet stayed until 26 December, when they proceeded south, carefully examining every inlet until, on 31 March, they cast anchor in a port which Magellan named

St. Julian. Here they remained for five months through the winter, which, as you know, is in southern latitudes at the same time as our summer. The cold was very severe, the food was poor, and the seamen began to grumble, and to talk of either killing their foreign commander or forcing him to return to Spain. Magellan put the chief grumblers in irons, but the same night the officers and crew of the *Concepcion* mutinied and seized the *San Antonio*, one of the two large vessels of the fleet. They were soon joined by the *Victoria*, and Magellan was left with two vessels, the *Trinidad* and the *Santiago*, against three. He at once sent off a boarding party under his brother-in-law, Barbosa, who recaptured the *Victoria* and killed her captain. Then with the *Victoria* and his two loyal vessels he barred the entrance to the bay, to prevent the escape of the other two ships. The mutineers came on, but after a sharp fight were forced to surrender, and Magellan made an example of the ringleaders by beheading two of them and putting two others ashore among the Patagonian natives.

At the coming of spring, the *Santiago* was sent down the coast to search for a way into the new ocean. She had not gone far, however, before she was wrecked in a violent storm, and her crew of thirty-five barely escaped with their lives. Magellan, with his four surviving ships, waited at St. Julian until the summer, and then continued the voyage which had been so long interrupted. Inlet after inlet was explored in vain, and again the crews became clamorous to return. It was plain, they said, that the land

extended to the South Pole; the farther south they went the wilder were the natives and the less fertile was the land; there were few provisions to be had ashore, and those they had brought with them were nearly exhausted. Magellan's only answer was that he would go on, even if he had to eat the leather from the ship's yards. At last, on 21 October, they found "an inlet like unto a bay", and two ships were sent in to explore. They had scarcely started when a gale arose, and they were driven helplessly before it. Rushing down the narrow sea between snow-clad mountains, the unhappy mariners expected at every turn to find that the inlet ended in rocky crags upon which they were doomed to destruction. Their companions, riding out the gale in such shelter as they could find at the entrance, had almost given them up for lost when, on the third day, the wind having gone down, the two ships reappeared with flags flying, guns firing, and the joyful news that they believed the inlet was the long-sought way into "the other sea".

The whole squadron then entered the strait, which to this day bears the name of its discoverer Magellan, and, after sailing through it for 300 miles, three of the ships emerged into the open sea. The fourth ship, sent to explore an inlet of the straits, took the opportunity of slinking off and returning to Spain. The rest of the squadron continued their course westwards across the new ocean, which, as it happened to be calm at the time, was named by Magellan the Pacific, and in March they arrived at the Ladrones. A month later they reached the Philippines, and here

Magellan was killed in a fight with some natives. Deprived of their leader, the Spaniards seem to have forgotten the main object of their voyage, and to have sailed from island to island, plundering the natives and quarrelling over the spoil. Two of the ships reached the Moluccas in November, 1521: one of them stayed there; the other, the *Victoria*, with forty-seven men on board, laid a course for the Cape of Good Hope, and after many perils arrived at San Lucar in September, 1522. Of the 236 men who had set out with Magellan three years before, only thirteen returned in the *Victoria*. They were received with great honour in Spain, and their captain, Sebastian del Cano, was granted a coat-of-arms on which appeared a globe surrounded with the motto: "Primus me circumdedisti" ("Thou first encompassed me").

From this time onwards the Spaniards competed with the Portuguese for the trade of the East Indies. The English made an attempt in 1553 to find a North-East passage through the Spitzbergen Sea to China, as a result of which the "Muscovy Company" was formed to trade with Russia; but, generally speaking, English maritime enterprise remained backward until the reign of Queen Elizabeth produced some of the boldest and ablest captains who have ever sailed the seas. In the time of this great Queen many trading expeditions were sent out to the West Indies, war-like descents were made upon the Spanish ports of South America, and the first British colony, Virginia, was founded in North America.

Drake, the most famous of the famous band of

Elizabethan seamen, was the first Englishman to sail round the world. Drake, as you know, had a score to pay off against the Spaniards, who had treated him badly in one of his early voyages to the Spanish Main, when he was only twenty-six years of age; and he paid it so liberally that his name became a terror to every Spanish ship upon the seas. In 1587, in one of his extraordinarily daring marauding expeditions, he captured a great Spanish vessel called the *San Felipe*, which was homeward bound from the East Indies. This, though not the richest of the many prizes which Drake captured, was in one respect the most important, for the vessel's papers disclosed the enormous profits which the Spaniards made out of their trade with India, and suggested to the English merchant adventurers that money might be made more easily by taking part in that trade than by robbing the Spanish settlements in the West Indies, or lying in wait upon the high seas for Spanish treasure ships. Some of them petitioned the Queen to give them a licence to trade with the East Indies, and in 1599 she granted a charter for this purpose to the Earl of Cumberland and 215 knights and merchants, thus founding the first East India Company.

That was the beginning of our great Indian Empire and our enormous Eastern trade. In the next twelve years, twelve voyages were made by British merchants to the East Indies. In 1613 a new company was formed which fitted out a fleet of four ships ranging in size from 200 to 650 tons. This squadron had a sharp fight with the Portuguese, who considered that

no one but themselves had any right to trade with the East; but the English were victorious, and in a few years our Eastern trade was firmly established.

The wars of the Commonwealth, which destroyed the naval supremacy of the Dutch, contributed in a large degree to the extension of trade with the East, and the annexation of Jamaica served to increase our trade with the West. Indeed, the Western trade did more than the Eastern to stimulate among merchants and shipbuilders that rivalry which is so necessary to progress in any direction. The East India trade was in the hands of the East India Company. No vessels but those of the Company could legally engage in it. On the other hand, the West Indian trade was open to all, and the result was the development on this route of a class of ships better adapted to mercantile operations than the "East Indiamen", which were partly cargo boats, partly passenger vessels, and partly men-of-war. When at last the trade of the East was thrown open to the world, shipbuilders in all maritime countries, but especially in England and America, began to design vessels suitable for carrying cargo either East or West. But of course then, as now, they continued to build ships for special purposes. The Americans, for instance, built ships for carrying cotton, and both Americans and English built ships for carrying tea.

To the Americans belongs the credit of having made greater improvements than any other nation in mercantile sailing ships, and their clippers became famous, not only for speed, but for the ease with which they could be worked by a small crew. Owing to the

abundance of timber in the New World, ships could be built more cheaply there than here, and American ingenuity introduced capstans, winches, and other labour-saving appliances which the old-fashioned seamen of this country long regarded with distrust. It was not until the middle of the nineteenth century, when British shipbuilders began to copy the best features of American ships, that British vessels recovered the position they had lost. By this time the introduction of steamboats upon the Atlantic proclaimed the doom of the fast-sailing clipper on that ocean. In favourable weather the clippers could easily outsail the steamers of those days. One of them, the *Sovereign of the Seas*, is said on one occasion to have maintained for twenty-four consecutive hours a speed of 18 miles an hour. In calms, however, or head winds the slowest of steamers could overhaul the fastest of clippers, and on an average voyage the clipper was easily beaten.

In the China trade, however, the clippers held their own for some years after they had disappeared from the Atlantic. One of the most important articles of this trade was tea, which at that time was much more profitable to the growers and the merchants than it is now. The Indian tea trade had not been developed, and the bulk of our tea came from China. Old ladies and gentlemen were much more particular about the quality of their tea than they seem to be nowadays, and they looked forward to each new season's tea as eagerly as some of their successors look forward to new potatoes. High prices were paid in the market for the earliest deliveries of each year's

crop, and there was keen competition among the captains of the China clippers to be the first to arrive in England with the precious little leaf. In the many races which resulted from this rivalry the Americans, generally speaking, had matters all their own way until 1856, when the *Lord of the Isles*, built by Messrs. Scott of Greenock, beat two of the fastest American clippers.

From that time forward Britain gradually recovered the position, which she has ever since maintained, of the first carrying nation of the world. Two things that happened about this period tended greatly to the advancement of her shipping. One of them was the American Civil War, which temporarily crippled American commerce; the other was a revolution in the science of shipbuilding, which deprived the Americans of the advantage of their cheap timber. Not only was steam taking the place of sails, but ships were being built of iron, a material produced abundantly and cheaply in this country, and in the making and fashioning of which our workmen excelled. The coming of steam and of construction in iron and steel opened a new chapter in the history of transport by sea as in that of transport by land, and helped in no small degree to exalt this country to the pinnacle of commercial greatness on which she stands to-day.

CHAPTER VIII

Modern Ocean Carriers

It would be impossible to say exactly when the idea of using steam for the purpose of ship propulsion first entered the mind of man. We know that as long ago as the year 1690 a French scientist discussed the subject, and that fifteen years later experiments were actually made with a steam-driven vessel; but it is highly probable that even then the notion was one of some antiquity. It was not, however, until the beginning of the nineteenth century that anything really worthy of note occurred. The credit for having put theory into practice must be divided between Henry Bell, of Glasgow, and Robert Fulton, an American.

Fulton was the first to get his vessel afloat, but both he and Bell had been conducting experiments for some considerable time previously, and on one occasion had met and compared notes. The American steamboat *Claremont* plied between New York and Albany; while Bell's vessel, the *Comet*, ran between Glasgow, Greenock, and Helensburgh. Interesting, however, as the history of these pioneer craft and their immediate successors would be, it has not much bearing upon the subject of deep-sea steam navigation, and we must therefore pass it by. The

man who first saw the enormous possibilities of the new method of propulsion—or, at any rate, the man who first took steps to turn them to account—was David Napier, a Scottish engineer who had made the castings for the engine of the *Comet*. In the year 1818 a steamer named the *Rob Roy*, built at Dumbarton and engined by Napier, began to run regularly between Greenock and Belfast; twelve months later the *Talbot*, for whose engines Napier was also responsible, was placed on the service between Holyhead and Dublin; and within a few years' time quite a number of seagoing steam vessels were afloat. It was in 1819 that a steam-driven ship first crossed the Atlantic, but the craft in question, the *Savannah*, was not entirely dependent on her engines. She was what we should call nowadays an auxiliary vessel—one, that is, in which the machinery is only an adjunct to the sail power, and is not employed when good progress can be made under canvas.

The real conquest of the Atlantic was made in 1833, when the *Royal William*—which had been running for some time between Quebec and Pictou, Nova Scotia—was dispatched to this country, accomplishing the journey in seventeen days. It is impossible to repress a smile when one conjures up a picture of this vessel as compared, say, with the 23-knot Cunard liner, the *Aquitania*. Her length was 176 feet, and her breadth 27 feet, and her engines were of 180 horse-power; the *Aquitania* is 901 feet long, has a breadth of 97 feet, and her engines—she is oil-fired—develop 60,000 horse-power. In the year 1838 there was great excitement in the shipping world. Two

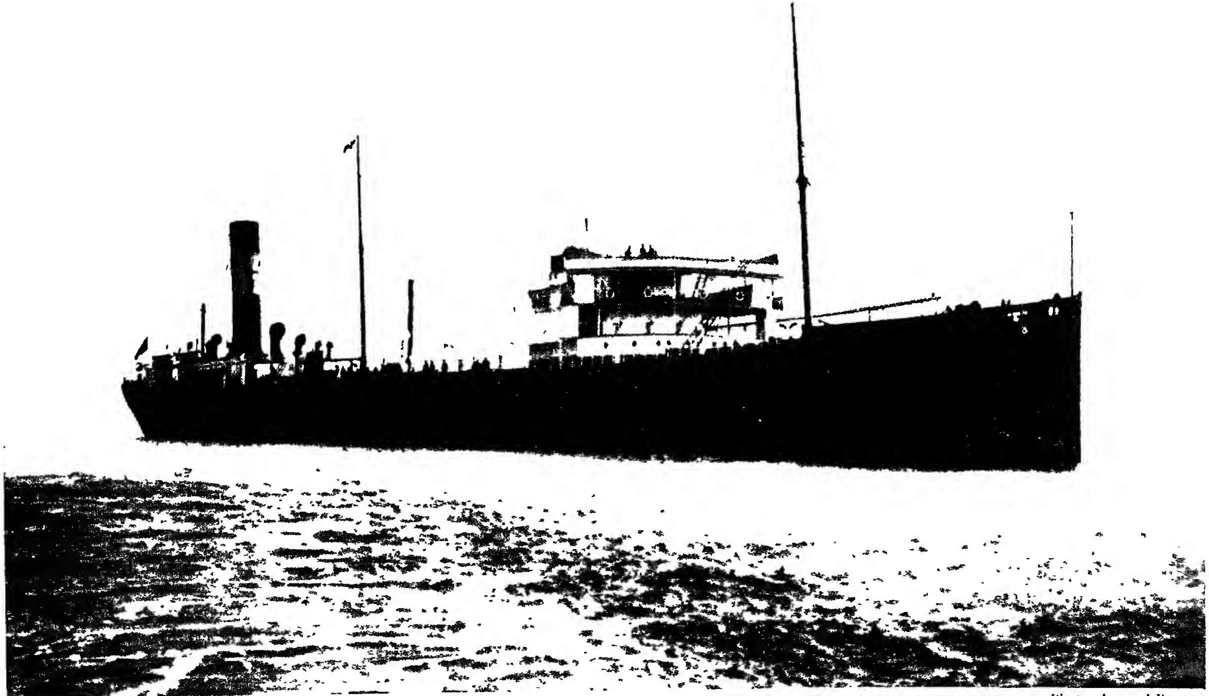


Photo Topical Press

THE *SAN FRATERNO*, A LARGE OIL TANKER

This vessel can carry about 15,000 tons of petroleum.

Chap. VIII.

rival companies had been formed for the purpose of starting a regular transatlantic service, and a race to New York ensued, the competitors being the *Sirius*, of 703 tons, and the *Great Western*, of 1320 tons. The first-named vessel left Cork Harbour on 4 April, and three days later the *Great Western* sailed from Bristol. The *Sirius*, thanks to her long start, won the race, but the other, with more than double her horse-power, was only a few hours behind. Imagine these two "puffing Billies" grunting their way across the Atlantic! A flier such as the *Aquitania* could have made circles round them, and would then have had to wait for them at the finish. Still, they did good work. They showed that a steam service for the North Atlantic was something more than a dream; that it was, in fact, a sound proposition. In the meantime, however, there had been developments in another direction. Thirteen years before the arrival of the *Sirius* electrified the good people of New York, the 479-ton paddle-steamer *Enterprise* had linked the east with the west. Leaving London on 16 August, 1825, she reached Calcutta, via the Cape of Good Hope, on 7 December. After being employed for some time in the Government service on the Indian coast, she commenced to run between Bombay and Suez, for the purpose of picking up passengers who had come by the overland route; but she broke down, and was replaced by the *Hugh Lindsay*.

It would be wearisome to trace the subsequent course of events in close detail. Each individual step made in developing and improving the new means of ocean transit was, without doubt, highly interesting

in itself, but to describe every forward movement fully would be to tell the same sort of tale over and over again. Let us therefore pass on to the day when something out of the common took place. In the year 1858 there was launched a vessel which was as great an advance on anything that had gone before, as a ship half a mile long would be to-day. I refer, of course, to the ill-fated *Great Eastern*, that unwieldy ship which was dogged by misfortune throughout her career. By common report the design of this mammoth is attributed entirely to Mr. I. K. Brunel, the famous engineer, but as a matter of fact he was only in part responsible for her, a Mr. Scott Russell, of Millwall, being the leading spirit. The twin sciences of naval architecture and engineering had, in those days, not made the progress which they have since achieved, and in consequence the *Great Eastern* was a hopeless failure. She was 675 feet long, and of 18,918 tons, and was propelled by paddles and a screw as well. Such a combination was, of course, ludicrous, and the 20-knot speed which the vessel was expected to attain dwindled down to about 14 knots in actual practice. Her ill luck began even before she was in the water. She was to have been launched on 3 November, 1857, but she stuck on the ways, and by an accident to a winch one man was killed and several were badly injured. It was not until the end of the following January that success crowned the efforts to get her afloat, and in the meantime her builders had gone bankrupt, and the company that owned her had to be wound up. In September, 1859, she made her

trial trip, and the occasion was marked by an explosion on board her, which killed six men and injured others. In her time she acted as a troopship, but the most useful work which she accomplished was that of laying submarine cables. At the close of her career she was used as a floating advertisement by a big Liverpool firm of wholesale providers, and in the end she was broken up on the shores of the Mersey.

Although in most respects such a gigantic mistake, she had one or two features which command respect. She was constructed, for example, with an inner skin, an arrangement which afterwards dropped into disuse for a while, but has now been revived in the case of the newest Atlantic liners. Again, she had a very large number of water-tight compartments, and it was to this, no doubt, that she owed the fact that she kept afloat after striking a rock during one of her voyages. Moreover, although she was such a hopeless failure herself, she had been highly useful as an experiment. It is only by finding how not to do a thing that men learn how to do it, and the *Great Eastern* had taught the first of these lessons most effectually. True, many years elapsed ere anything like her in point of size was again attempted, but in the meantime the naval architects and shipbuilders were gradually working up to her standard again, and, of course, were profiting by the experience gained from her. Not very long after the *Great Eastern* had been weighed in the balance and found wanting, paddle wheels as a method of propulsion for ocean-going steamers were finally abandoned, while another

step of vital importance was that of using steel, instead of iron, as the material of which ships' hulls were constructed. It is safe to say that but for these two alterations in shipbuilding practice we should never have had an *Olympic* or an *Aquitania*.

In due course there came another innovation which had an equally far-reaching effect—i.e. the adoption of twin screws in place of a single propeller. The credit for introducing this system belongs to the late Mr. Becket Hill, then head of the Allan Line, but his example was quickly followed by other shipowners. The advantages of the arrangement are so obvious as scarcely to need explanation. In the old days a vessel which had a breakdown in her engine-room, or fractured her propeller shaft, was as helpless as a log. She might drift about for weeks if she had not the good fortune to fall in with another ship, and in the meantime those on board her might be brought to the brink of starvation. If a twin-screw boat meets with a similar accident she can easily reach port with the aid of her remaining propeller, the only trouble experienced being that her speed is somewhat diminished. Again, she is far more easily manœuvred than a single-screw vessel, and if, by any mischance, her rudder is carried away or put out of action, she can still be steered, whereas the older type of ship would, in such circumstances, be at the mercy of the waves.

But we have run rather far ahead in our story of the process of evolution which has led up to the modern liner. We must hark back to the year 1879, for it was then that the question of high speed first

came really to the fore. On 31 May, 1879, there sailed from the Mersey, bound for New York, a vessel whose name for a long while was a household word. She was the *Arizona*, owned by the Guion Line, and she brought the North Atlantic "record" down to 7 days, 8 hours, and 11 minutes. A sister ship, the *Alaska*, was launched a couple of years later, and she proceeded to put even the performances of the *Arizona* into the shade, doing the run in about 6 days, 18½ hours. "Ocean greyhounds" was the term which the public applied to these fliers; and so much attention did their high speed attract, that a struggle for supremacy in the matter of pace set in at once amongst the North Atlantic steamship lines.

For a while, every big company running boats on the New York route strove to outdo its rivals, but the craze of late seems to have died away. The White Star Line were the first to abandon it, and the other lines have gradually followed suit. It will be noted, for instance, that the *Mauretania*, put into service just before the war, still holds the Atlantic speed record. We have spoken of the contest as a "craze", because it is doubtful whether the game was ever really worth the candle. The expense of very high speed is something enormous. For every extra knot per hour above a certain number the coal consumption almost doubles itself; and when one remembers that the quantities consumed may range up to almost 1000 tons per day for a single steamer, the effect of this item on a big steamship company's expenditure-sheet becomes obvious. Nowadays, the tendency seems to be to give the passenger more for his

money in other directions; to take it for granted that he will patronize, not the vessel that can land him, say, in New York in half an hour less time than any other boat, but the one that will offer him the most luxury.

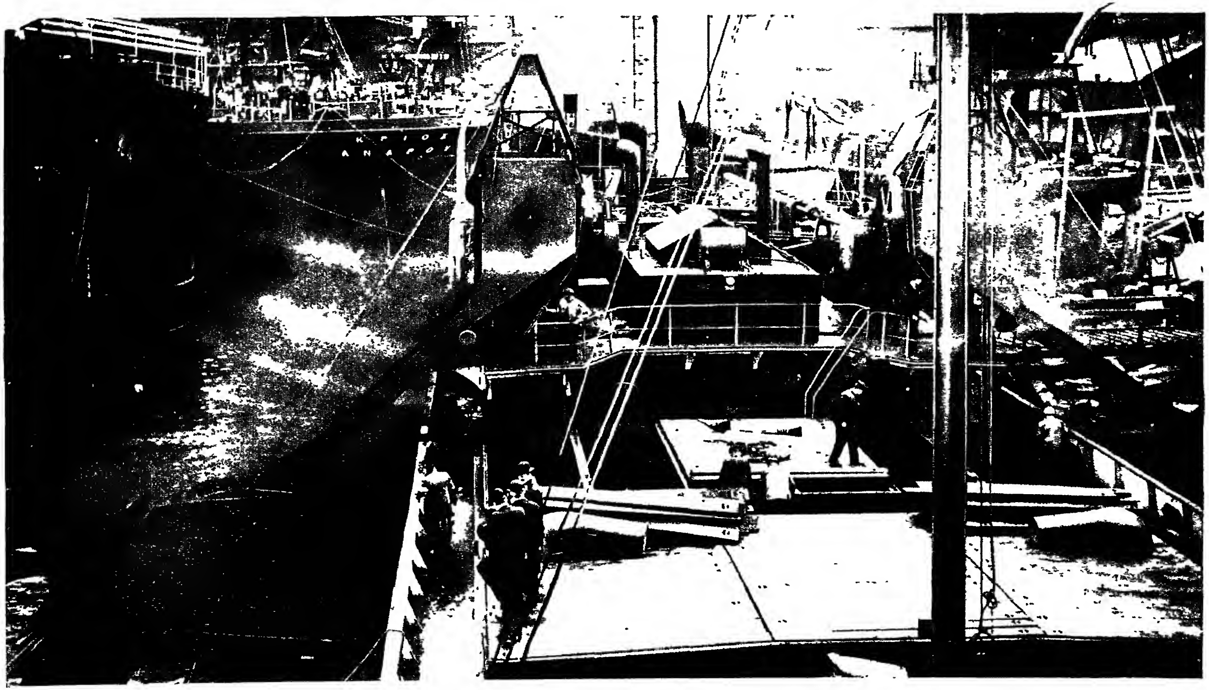
The developments which have taken place in the latter connection during recent years are positively sensational. Not so very long ago the passenger liner which had a fairly handsome dining-saloon, a comfortable smoking-room, and a daintily furnished drawing-room for the ladies, was regarded as giving all that the heart of the traveller could desire. To-day she would be indeed a "back number". One frequently hears our modern liners described as floating hotels, but the term is utterly inadequate. "Floating palaces" would be a better expression. The twentieth-century voyager demands —and is given—music-rooms, à la carte restaurants and grill rooms, palm gardens, gymnasia, swimming baths, racquet courts, and electric lifts. In some of the biggest Atlantic liners there is even a spacious ball-room. The special suites of rooms which are provided for those whose purses are long enough to pay for them are fit for a king, and in some instances they open out on to a private promenade deck, whereon the fortunate millionaire and his family can lounge the day away without being stared at by less favoured mortals. The one great aim of the big steamship companies, in fact, seems to be to make the passenger forget that he is afloat, and to give him the impression that he is taking a holiday in some royal residence of a peculiarly

luxurious character. It is difficult to think of any further additions which could be made to the list of attractions held out by the "crack" liner of to-day.

One sometimes hears it jokingly suggested that the steamers engaged on the transatlantic route will in time be big enough to have golf links aboard them, but that day will not come while the present generation is alive, for the simple reason that our passenger liners have almost reached the limit in the matter of size. It would, of course, be possible to build boats twice or three times as big as the biggest now afloat, but there is an obstacle, apart from any difficulty with regard to construction, which for many years will prevent anything of that sort taking place. It is one that can easily be explained. Every vessel, it must be understood, has to go into dry dock at intervals. The exterior of her hull is continually becoming encrusted with weed and other marine growths, and if these were not scraped away periodically her speed would be so diminished that she would become as slow as the veriest old tub. She also requires to be frequently painted with a composition which serves the double purpose of preventing corrosion and, to a certain extent, keeping in check the accumulation of weed, &c. Naturally, these operations cannot be performed while she is afloat, and accordingly she is placed in dry dock—in other words, in a dock from which the water can be pumped out, leaving her propped up, high and dry. Again, she may meet with an accident which necessitates repairs. She may, for example, touch the bottom in a shallow channel, with the result that some of her plates are

broken or buckled. In order that she may be repaired she must go into dry dock, for the work could not be done satisfactorily by divers. Thus it will be seen that a dry dock big enough to take her in is an absolutely essential factor in the life of a modern steamer. Now the largest one in the world is the Gladstone Dock at Liverpool, and its length is 1050 feet, or only 94 feet more than the length of the *Majestic*. It is therefore evident that a vessel of, say, 1100 feet would be in as sorry a plight as the dove which escaped from the Ark. She would, indeed, be even worse off, for the dove could get back into the Ark, but the steamer could not get back into the shipbuilding yard whence she had come. Her hull would become more and more overgrown, and directly she met with a slight accident—an event which would inevitably happen sooner or later—she would be at once a useless hulk.

"But why", the reader will doubtless ask, "should not larger dry docks be built?" The answer is that they are terribly expensive affairs to construct, and that they take years to build. If it were absolutely certain that steamers of 1500 feet in length were presently to be built, someone would, no doubt, be willing to provide a dry dock large enough to take them in, but while there is a doubt about the matter no one is ready to spend the vast sum of money which would be required. Thus the question works round in a sort of circle. Bigger vessels cannot be built because there are no dry docks for them, and bigger dry docks cannot be constructed because there are no vessels large enough to make them pay. We



A COLLIER DISCHARGING

It is not an uncommon thing for a collier of this type to get rid of her cargo at the rate of 700 or 800 tons an hour. Machinery trims the coal, puts it on conveyors, and loads it into railway wagons or barges.

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may therefore take it for granted that it will be some considerable while before we have another period of sensational developments in the matter of big-ship building.

This, of course, refers to the North Atlantic trade, where the leviathans are to be found. On other routes the process of evolution will probably continue for some time to come, for the vessels employed on them have not yet reached anything like the limit in the way of size, and consequently there is room for them to expand. It is, perhaps, in the Cape and South American trades that the most important strides have been made during recent years, and it is in these directions, too, that we shall probably see the most striking developments in the near future. In 1889 the finest vessel running to South Africa was the *Roslin Castle*, of 4487 tons. To-day the biggest boat in the Union-Castle fleet is the *Carnarvon Castle*, of 20,063 tons. The *Clyde*, built in 1890 for the Royal Mail Steam Packet Company's South American service, was of 5618 tons. Now that famous company has such vessels as the *Alcantara* and the *Asturias*, each of 22,150 tons.

Naturally, everything depends on the manner in which the trade on each route expands. Shipowners, after all, are only carriers. They do not create the traffic; they simply provide the means for conveying it from one point to another, and they therefore have to adjust their arrangements to meet the requirements of their customers. It would be useless, for instance, to put an *Aquitania* on the service between this country and South Africa, for a very large proportion of her

passenger accommodation would never be filled, and she would thus always run at a dead loss to the company that owned her. At the same time, although the shipowner has to keep the size of his vessels within the limits of the demand, he is constantly striving to improve them in other respects, not merely by rendering them more attractive, but by making them more economical to run. There is probably no other industry in which so many and such drastic changes are continually being effected. If he wishes to be successful the modern shipowner must be ever on the alert. New inventions and new methods are all the while presenting themselves, and the man who neglected to adopt them would soon be hopelessly beaten by his competitors.

The marine engine of to-day is a vastly different affair from that which propelled the *Comet*. I do not, of course, refer simply to the matter of size and power. It is in the entire principle of working that the change has taken place. Indeed, it might well be said that, save for the fact that steam is the motive power, there is scarcely any resemblance between the old and the new. The adoption of the triple-expansion system practically revolutionized ship propulsion, giving a tremendous increase of power or a corresponding decrease of expense. In the triple-expansion engine the steam is used three times over, and thus almost every ounce of energy which it contains is turned to account. From the boilers it passes to what is known as the high-pressure cylinder; from there it goes to the intermediate cylinder, and so in due course to the low-pressure cylinder—driving a piston in each, and

so giving a threefold impulse. In some modern steamers the principle is carried farther still, quadruple-expansion engines being employed. An engine which is put in motion by admitting steam to a cylinder and so forcing up a piston is known as a reciprocating engine; but towards the end of the nineteenth century there came a fresh development which has carried marine engineering a long stage farther.

This development was the coming of the turbine principle, the invention of Mr.—now Sir Charles—Parsons. By means of this system, direct action is obtained. The steam from the boilers impinges on a multitude of little blades set on a wheel which is attached to the propeller shaft. Thus there is none of that loss of power which invariably occurs when an arrangement of levers interposes between the impulse and final action. For a considerable time, however, there were drawbacks attached to the turbine principle. For instance, it was not possible to reverse the engines—a most serious disadvantage, for ships must be able to go astern when occasion requires. This obstacle was surmounted by the introduction of a separate turbine for reversing purposes. Another difficulty has been that the turbine is apt to drive the propeller at too high a speed. To call this a drawback may seem contradictory, but the fact is that it is not desirable that a propeller should revolve with extreme rapidity. When it does so it loses force. What is known as a "cave" is created in the water, and the blades fail to get a proper grip. But here again the difficulty was surmounted. A system of gearing between the turbine "rotor" and the propeller was

introduced, with the result that the latter revolves at a much lower speed than the former. The finest ships afloat are turbine-driven, the boilers being fired by oil fuel.

While the steam engine has been undergoing the long process of evolution that has brought it to such a pitch of perfection, there has arisen a rival which in the course of time will possibly drive it out of the field. Only a few years have elapsed since the Diesel oil engine was first heard of, yet it has already made wonderful strides, and, when certain difficulties have been overcome, will almost certainly take the premier place as a means of ship propulsion. It may be as well to explain here that there is a vast difference between a vessel which burns oil fuel and one which is driven by oil engines. A great many people confuse the two, but in reality they are as far apart as the steamer and the sailing ship. In the one instance oil is sprayed into the furnaces, and is thus simply employed as a substitute for coal for the purpose of raising the steam which drives the engines in the ordinary way; in the other it drives the engine itself, in much the same way that petrol provides the motive power for a motor car. Strictly speaking, however, it is not correct to compare the Diesel engine with the motor-car engine. In the case of the latter a very high-grade oil is employed, and the impulse is provided by a succession of explosions; while in the former the oil used is of the crudest and heaviest description, and the impulse is more in the nature of a push.

Up to the present, the Diesel engine has been found

more suitable for comparatively small vessels than for those of large size, but there are some very fine ships running on oil engines, including large passenger vessels like the Royal Mail Steam Packet Company's *Asturias.* The oil engine provides the most economical method of ship propulsion yet devised. Under very favourable conditions, one ton of oil-fuel as now used in Diesel engines will drive a vessel three times as far as 1 ton of coal burnt in the driving of a steamship.

The advantages attached to the oil-engine system of propulsion are many. In the first place, the machinery takes up far less space than does the steam engine, and the vessel's carrying capacity—in other words, her earning power—is correspondingly increased. Then, again, the number of men required is less, a condition of affairs which also adds to the available space for cargo or passengers. Thirdly, the amount of room which in a steamer would be occupied by coal bunkers is to be added to that gained in the manner shown above. Instead of needing separate compartments, the oil can be stored in the double bottom of the ship, a space which in a steamer is occupied by water ballast. By this arrangement, too, the trim of the ship is more easily preserved. In the case of a steamer the gradual withdrawal of the coal from the bunkers leaves empty spaces; but when the oil is withdrawn from one of the divisions of the double bottom of a motor ship, water is pumped in to replace it, and the vessel herself is thus unaffected by the loss. Amongst other advantages may be mentioned the cleanliness of oil, as contrasted with the

extreme dirtiness of coal; the rapidity with which the former can be pumped on board, as compared with the slow process of "coaling ship"; and the quickness with which the vessel can be made ready to proceed to sea. It takes many hours to raise steam in a big boiler, whereas a motor engine can be started at a moment's notice.

It must not, of course, be supposed, from what we have said, that the days of steam are nearly at an end. Oil may gain the victory sooner or later, but the fight will be a long and uphill one. In all probability we shall have a repetition of the story of the battle between steam and wind propulsion, the newcomer gradually wearing down its rival.

There are, by the way, other Richmonds, besides the oil engine, in the field. For example, there is the "gas producer" engine, a contrivance which makes its own gas, and then uses it on the explosion principle. There is also electricity to be considered. Some people profess to believe that the electrically propelled ship has a big future before it, but they are not many in number, and of late their voice has not been heard very often. Indeed, the process of producing electricity will have to undergo a truly revolutionary change before that medium can be profitably employed for purposes of propulsion. It is, of course, very largely used aboard ship nowadays for lighting purposes. Every big liner employs it exclusively, and a great proportion of our tramp steamers are electrically lighted. In other directions, too, electricity plays a highly important part on board the vessels of our mercantile marine. Indeed, one could

write a long chapter on the purposes to which it is put. It is used for heating saloons and staterooms, for ventilating the passenger quarters, for working lifts, for controlling the closing of the doors in the water-tight bulkheads, and for providing communication between bridge and engine room; while it is scarcely necessary to remind you of the invaluable services which it has rendered in another direction—that of wireless telegraphy.

The inland dweller who knows little or nothing of the intricacies of shipping usually supposes that all steamers are built on very much the same plan. In reality, however, there are many different systems of construction. Where the cargo boat is concerned, the great aim of the shipbuilder is to provide large, clear holds, coupled with the utmost possible structural strength, and a moment's reflection will show the reader the difficulty of combining these features. Consider the tremendous strains to which a vessel is subjected when she is in a heavy sea. She is, in effect, a big box, made of steel plates which are riveted together; yet she has to be able to withstand conditions more trying than anything else made by the hands of man ever meets with. At one moment she is hanging, like a seesaw, on the crest of a huge wave, with practically no support at all for her two ends; at the next she is playing the part of a bridge from one great billow to another, with her middle portion unsupported; and all the while she is pitching and tossing and rolling, and, last but not least, is forcing her way through the water. But for the scientific manner in which she is strengthened internally

she would sag and break. This element of strength is imparted to her by steel beams—framing is the technical word—running lengthways and crosswise, and it will be evident that if there were too many of the latter the usefulness of the vessel would be seriously interfered with. Her holds must be clear of obstructions, and they must be large, for a boat cut up into a number of small compartments would be quite useless as a cargo carrier. Moreover, it is necessary to keep down the weight of the ship as much as possible. Shipbuilders are all the while striving after perfection in these respects, and many patents have been taken out for new principles of construction.

The most successful of these has been that of a Mr. Isherwood, and the majority of new cargo boats of the better class are now being constructed on the lines laid down by his system. What Mr. Isherwood has aimed at is to give the strength longitudinally instead of transversely. It would not be possible to explain his process without going into technicalities, but if the reader will imagine a huge box, of which the walls are fortified with a complicated system of girders, he will get a fair idea of what the interior of an "Isherwood" vessel is like. Externally, of course, she looks much the same as any other craft. The principle has been particularly successful in its application to oil-tank steamers, and this, by the way, brings us to the consideration of another special type of vessel. The "oil-tanker", as her name implies, carries nothing but oil, and carries it in bulk. She is, in fact, an ocean-going tank. Tank steamers are

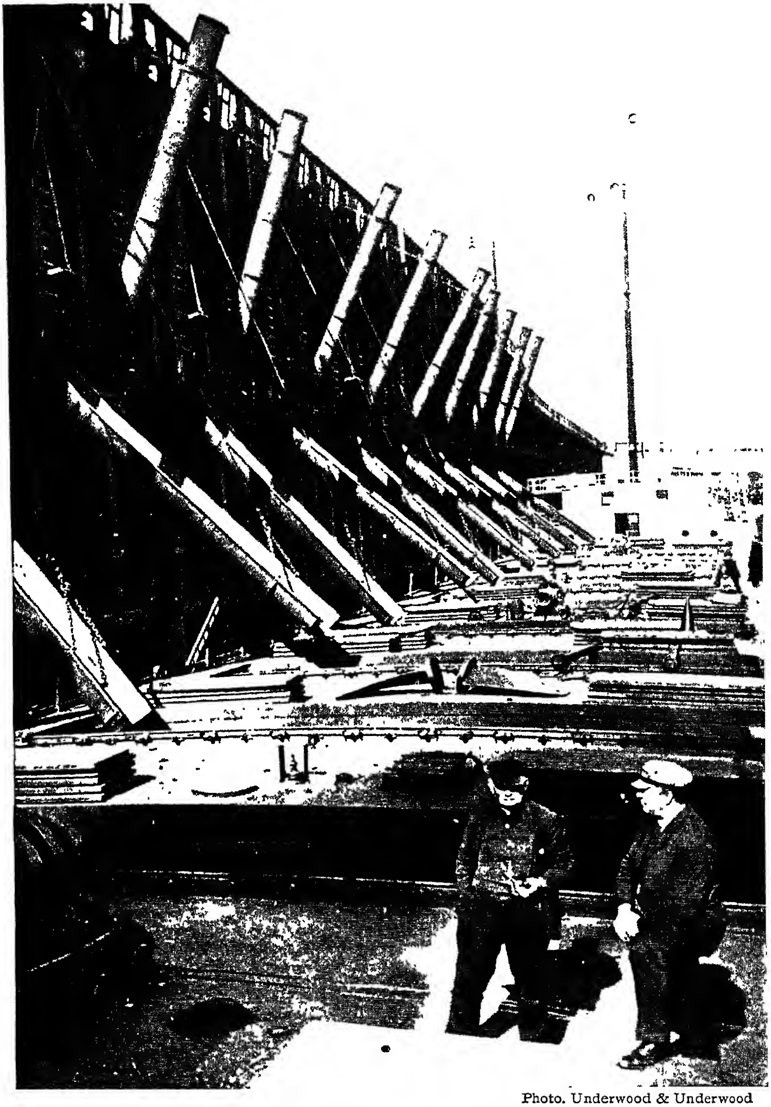


Photo. Underwood & Underwood

A "BULK-FREIGHTER" LOADING ORE

The carriers on the great lakes are virtually enormous barges, so built that their cargoes can be loaded, trimmed, and unloaded with the utmost dispatch. Note that the vessel here is loading into nine hatchways simultaneously. *Page* 198

to be met with on every one of the seven seas, for nowadays oil is obtained practically all over the world.

At some places the method of loading them is most interesting. At certain ports in the Gulf of Mexico, for instance, the "tanker" lies at a distance of fully 2 miles, and the oil is pumped out to her through a pipe line laid along the bed of the sea. The reason for this is that at each of these ports there is a dangerous bar, and that it is unsafe for vessels of any considerable size to venture close in. It would, of course, be possible to construct harbour works, but the trade is not sufficiently large to warrant the heavy expense which would be entailed. Therefore, as the "tankers" cannot go in to get their liquid cargo, the cargo has to be sent out to them. The carriage of such large quantities of an inflammable and explosive material is, naturally, attended by a high degree of danger, and in the past there have been some ugly accidents with boats of this type. Nowadays, however, the arrangements are so perfect, and the precautions taken are so stringent, that casualties are rarely heard of. At the end of each voyage the oil tanks, after being emptied of their contents, are cleared of the gases which remain by means of steam, pumped into them at high pressure. Were this not done, an empty tank steamer would be far more dangerous than a gunpowder factory, or, rather, a collection of tanks. Not a very fascinating sort of ship this, perhaps; but in the shipping industry the importance of a boat must not be measured by her picturesqueness. There are hundreds of oil-tankers

afloat, and the extent of the trade in which they are engaged will be realized when we state that the largest of them will carry about 15,000 tons of oil. A considerable number of them burn oil fuel for raising steam, but there is an increasing tendency to have them propelled by Diesel engines.

A trade which has developed enormously of late years is that of chilled and frozen meat, and a special type of steamer has come into existence to meet its requirements. At the present moment there are considerably more than 200 such vessels in the British mercantile marine, and between them they have capacity for carrying some 15,000,000 carcasses of frozen meat. When it is remembered that in bringing their cargoes to the United Kingdom these boats have to pass through the torrid heat of the Equator, it will readily be understood that their internal arrangements are of a highly complicated character. If the refrigerating machinery were to fail in its duty for ever so short a space of time, many thousands of pounds' worth of meat would be ruined. The process of creating artificial coldness, too, is not the only one that comes into play. The chambers in which the meat is stored have to be insulated in such a fashion that the external heat cannot affect the temperature inside, a task that is by no means so easy as it sounds. When the tropical sun is beating down on a vessel, the walls of her interior structures would quickly become warm if they were constructed on ordinary lines, and thus the work of her refrigerating machinery would be nullified. Therefore it becomes necessary to set up a barrier against the heat; and

this is done by erecting an inner wall of wood, and filling the space between it and the outer wall with non-conducting material, which usually consists of charcoal or silicate cotton. With regard to the machinery itself, it would be difficult to explain fully the various processes employed without going into details which would be unintelligible to any but an expert engineer.

There are three different systems in use—air compression, ammonia compression, and carbonic anhydride compression. In the first there is a continual withdrawal of air from the cargo chamber, and this air, as it comes out, is compressed, an operation which raises its temperature very greatly. Next it passes through coolers, which bring its temperature down again. Then it is allowed to expand suddenly, the result being that its temperature drops to about $-80°$ F.; and while in this condition it is sent back to the cargo chamber, whence in due course it is presently withdrawn again, to undergo the same process anew. In the case of the ammonia system, the operation may be best described as one of alternately gasifying and liquefying the ammonia as it passes through coils, the result being an enormous reduction in the temperature of the surrounding air. In the carbonic anhydride system the process is much the same.

It must not be supposed, by the way, that the steamers fitted with refrigerating machinery carry nothing but chilled or frozen meat. Many of them are fine passenger liners. Some of the P. & O. boats, for example, have refrigeration installations; while

amongst other notable companies which have vessels fitted in this manner are the Royal Mail Steam Packet Company, the Orient Line, the White Star Line—in the case of their Australian service—the Lamport & Holt Line, and the Nelson Line. At some of the South American ports—whence comes the greater proportion of the chilled beef shipped to this country—there are huge barges fitted up with refrigerating machinery and insulated cargo space. These are employed in carrying the meat from the depots wherein it has been stored ashore to the steamer which is to take it overseas. Some of these craft are huge concerns, over 200 feet in length, and having 60,000 cubic feet of insulated space aboard them. The magnitude of the whole trade will be realized when we state that within the space of a single year something like 4,500,000 quarters of frozen and chilled meat are brought to this country from abroad, to say nothing of twelve or thirteen million carcasses of mutton and lamb.

The humble "collier" is by no means the least interesting unit in the mercantile marine of a country which produces and consumes vast quantities of coal. Those of my readers who are not familiar with the work of our big seaports are doubtless accustomed to picture the coal carrier as a dirty old tub—an ugly, ungainly little craft, as unlike the smart liner as the coal merchant's cart is unlike a luxurious motor car. It will probably surprise them to learn that many of our modern colliers are really handsome boats of considerable tonnage, fit to go anywhere, and equipped with complicated machinery for discharging their

cargoes. It must be remembered that the carrying of coal from one port to another round the coasts of the United Kingdom is only an item in the entire trade. There are vast depots overseas, thousands of miles away, where fuel must be stored for the passenger liner or the tramp steamer to pick it up when required; and it is the collier which carries out the supplies to these centres. Thus she is as much an ocean-going craft as the biggest liner of them all.

In shipbuilding, the construction of the fine steamers engaged in this trade is now recognized as quite a distinct branch in itself. Constant improvements are being effected, while individual vessels are specially designed for the particular routes on which they are to be employed. So perfect are the internal arrangements of some of our most modern colliers that scarcely any manual assistance is required in discharging their huge cargoes. Machinery trims the coal, puts it on to conveyers, runs it ashore, and pours it into the trucks which are standing on the quay, only about half a dozen men being needed to superintend the operation. It is not an uncommon thing for a vessel of this type to be able to get rid of her cargo at the rate of 700 or 800 tons an hour. Some of them, too, carry a weighing apparatus known as the porhydrometer, which automatically registers every ton as it goes out of the ship. Probably the largest collier in the world is the *Neptune*, owned by the United States Government, and employed in coaling the war vessels of the American navy. She is 542 feet long and 65 feet wide, her displacement being about 19,000 tons. These, of course, are exceptional figures

for a craft of this nature, but many of our own commercial colliers are of decidedly substantial dimensions. The *Rouen*, for example, owned by the well-known firm of Furness, Withy & Co., Ltd., has a length of 290 feet and a breadth of 40 feet, 2 inches; while the *Sheaf Arrow*, the property of a Newcastle company, is 280 feet long, with a breadth of 40 feet, 1½ inches. The importance of the trade carried on by these craft may be gauged by the fact that in the year 1911 the amount of coal exported from this country reached the gigantic total of 64,599,266 tons.

So fascinating a creature is the great passenger liner, with her elegance and smartness, her size and her luxury, that people whose lifework does not bring them into constant touch with shipping are apt to overlook the importance to this country of the "tramp" steamer. And yet, without that vessel, we should all be starving at the end of a fortnight. This is not in the slightest degree an exaggeration. If every tramp steamer in the British mercantile marine were to be suddenly held up at sea and prevented from reaching our shores, the people of these islands would, within the short space of a couple of weeks, be face to face with absolute starvation. Day by day, year in and year out, vast food supplies are pouring in through our seaports, and it is the tramp steamer that brings them. To those who know her, her work is full of romance. There is no corner of the world into which she does not poke her snub nose. Sometimes her voyage may extend over only a few weeks; at other times it may be spun out for years. She may make a run out to the Black Sea and back, or she

may go from here to South America, and from South America to Australia, and from Australia across to Chile, and so home again round the storm-ridden Cape Horn. Like the British army, she is "ready to go anywhere and do anything". Incidentally, she sometimes makes a fortune for her owners. The names of the great passenger lines are household words, but there are in this country many shipowning companies which, while they are never heard of except by people connected with the shipping industry, are of almost equal importance. Capital to the extent of scores of millions of pounds is locked up in the cargo-carrying vessels which sail under the British flag. At the present moment the total tonnage of our mercantile marine is considerably over 21,000,000 tons, and it is safe to say that from 60 to 70 per cent of this huge figure is in the shape of tramp steamers. It would be well if someone could devise a better name than "tramp" for the vessels which do such yeoman service. It is an ugly term, and one that is calculated to inspire contempt, whereas in truth we have reason to be intensely proud of the craft to which it is applied.

Few people in this country have any idea of the extent of the shipping trade on the Great Lakes of America, or of the size of the vessels engaged in it. The craft plying on these inland seas are, of course, of a type altogether different from the ordinary ocean-going steamer; but many of them are of huge size, and the amount of cargo which, between them, they carry during the course of a year is enormous. The majority of them might well be described as glorified barges, if one may apply such a term to a vessel which

can convey as much as 12,000 tons of merchandise. Despite their great size they are comparatively shallow, the reason for this being that they have to pass through channels where the water is shallow. Iron ore forms the principal item in the traffic on the Great Lakes, but tremendous quantities of coal and grain are also carried, while lumber plays an important part too.

There is, of course, a number of passenger boats employed on these waters, but it is with the "bulk freighter", as the Americans call the Great Lakes cargo boat, that the main interest lies. As the name indicates, these craft carry "bulk" cargoes, i.e. cargoes composed entirely of one class of natural product, as distinguished from those which consist of varied assortments of manufactured goods. The boats themselves are so designed as to be able to take in and get rid of their freightage with the utmost possible rapidity. It is on record that one of them discharged 10,234 tons of iron ore in 4 hours, 6 minutes, an average rate of about 41½ tons per minute. The work of loading them is performed at an even more sensational pace, the record in this respect being 10,111 tons in 39 minutes, an average of 259 tons per minute. One can imagine the thunderous roar which would accompany the operation of pouring a heavy mineral into a vessel at this prodigious speed. The "bulk freighter" always has her machinery aft, an arrangement which, while it certainly does not make for elegance of appearance, is very convenient for the purpose of dealing with the class of cargo which she carries.

Although employed in such a rough-and-ready trade, these craft are, as a rule, far in advance of the ocean-going tramp steamer in the matter of their internal fittings. In most instances the crew's quarters are provided with shower baths, an arrangement unheard of in the case of the deep-sea tramp; while the captain's room is usually a thoroughly comfortable apartment, quite unlike the "poky" little cupboard with which the humbler class of British skipper has to be satisfied. The majority of the boats, too, are lit throughout by electricity, and have telephones for purposes of communication between the forecastle and the poop. They are, however, very prone to meet with disaster, a result, perhaps, of their peculiar type of construction—and also, maybe, of American slap-dash methods. In the year 1910 no fewer than nineteen were totally lost; while during the ten years 1901–10 the casualties recorded, great and small, reached the heavy total of 3031, involving a loss of nearly $15,300,000. Fire plays a conspicuous part amongst the sources of disaster, a state of affairs which can only be attributed to carelessness.

It would be scarcely fair to conclude our remarks on ships and shipping without making any reference to that absolutely indispensable craft, the dredger. But for the services which she renders, the development of the ocean-going vessel would have been arrested long ago. Our great ports, such as Liverpool or Southampton, would have been inaccessible to any but comparatively small boats, while giants like the *Olympic* or the *Mauretania* would have been out of the question. So important, indeed, is the dredger

that the work of constructing her has become quite a specialized branch of the shipbuilding industry. It is on the Clyde that most of these vessels are built, and there are two types—the bucket dredger and the suction dredger. The former is used in places where the material which has to be removed is of a solid nature, while the latter is employed when sand, mud, or gravel has to be dealt with. Both are capable of achieving truly wonderful results. The bucket dredger will cut a path through hard sandstone as easily as if it were cheese, while the suction dredger can make a sandbank melt away like magic. It is hardly necessary to give much in the way of a description of the two types, for their names speak for themselves. In the bucket dredger we have a number of steel buckets running on an endless chain, and in the other type the dredging apparatus consists of a huge pipe, up which the sand or mud is sucked by powerful pumps.

As an illustration of the amount of work which is done by these craft, I may tell you that, in removing two banks which blocked the way into the River Mersey, 126,000,000 tons of sand were cleared away by the suction process; and that a bucket dredger recently constructed at Paisley can bring up 2000 tons of solid material per hour from a depth of 50 feet. Although they do not belong to the ocean-going class, these craft sometimes make very long journeys, travelling to such far-distant parts of the earth as Australia or New Zealand, in order to dredge new channels to the harbours there. As a rule, they are towed to their destinations.

CHAPTER IX

Railways and Railway Builders

THE city sleeps. For the few short hours of night its wheels have ceased to hum, and its tens of thousands of workers have ceased to struggle. Lethean dew holds all in a sweet equality; hopes and fears and all the terrors of the battle are oblivion. The day's smoke has been swept away, and the moon peeps through the night wrack to take toll of those whose limbs are stiffening in their last sleep, to welcome the babes that will take their place, making the city solemn and beautiful with its smile.

That is the sort of picture of a sleeping city that is familiar enough in these days of cheap novels. I have read the same kind of thing a hundred times. Let us see whether we cannot find an aspect that is not quite so trite and commonplace, though, mark you, our city under the moon is so truly a solemn and beautiful thing that it fills us with pity for the helpless words that would try to picture it. In every city there are corners where men work furiously while their fellows sleep, and give never a thought to the smiling moon. Newspaper offices are hives of industry in the wee sma' hours, sometimes so are mills and factories; and a journey at dead of night through

the Potteries or one of the great iron-smelting districts will reveal a dozen Valleys of Hinnom, lurid and frightful, with fierce flames continually licking at the darkness. Yet it is not with these that we have to do, but with an industry of the night that is far greater. An industry this on which all others exist. Without it there would be no newspapers, no mills or factories, no potteries or blast furnaces. I speak of the hub of the city's life, the veins through which courses the lifeblood of its trade; and saying this, I have told you that I speak of the railway.

An industry of the night? Truly. And I want to hold the curtain aside for a moment while you peep at the wonders of a great goods station as they are revealed at night-time.

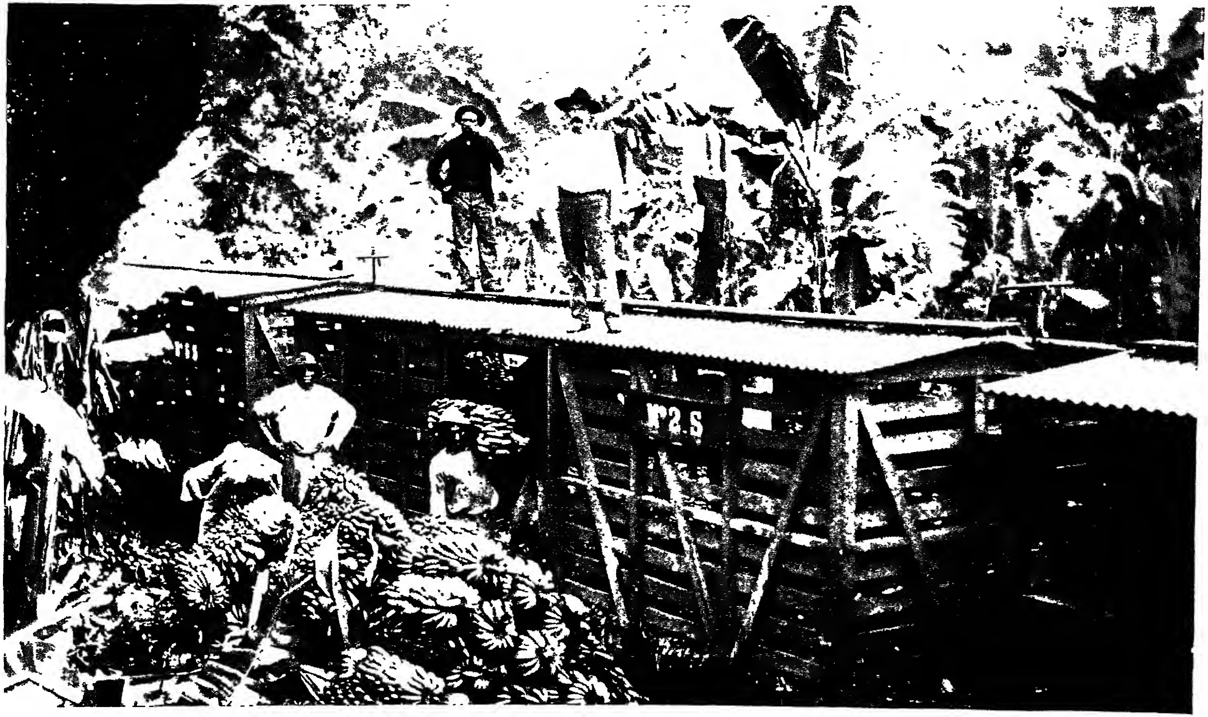
Come quietly then (strangers get in the way and are disliked), and let us creep into the station yard. *A lot of carts?* Yes—mind that motor van! What! —*they're funny carts?* Ah! To be sure, so they are; insulated vans for carrying frozen meat. But we will get inside the station—this way, up on the loading platform—and see what goes on there. Now look at this train, with half its vans "struck"; small wonder that a lot of vans are needed to cart its freight. Yes, it is all meat—frozen meat from the River Plate—twenty van loads in all. *Enough to feed a multitude.* Well, there are two hundred thousand mouths to feed in this city, no mean multitude. Bless you, this little lot wouldn't go far in stocking the butchers' shops. Twenty vans, each with 60 quarters — 1200 in all. It looks a lot when you see it all together, yet it is but a scrap in the giant's maw. Much of your

meat comes straight from the municipal abattoirs; and when—— Ah! here you are: look along the dock now—a new train has just backed in; now the double doors of the vans are unbarred, porters and barrows appear from nowhere in an instant, a dozen fresh carts are backing on to the platform. *More meat!* Yes, this train has been run up from Scotland at express speed, and its freight of prime beef must be rushed off to the meat market before the stalls open at four o'clock this morning. Yes, it is hot work for the porters. They have to race against time in order to provide your dinner. The rush is only beginning—there are plenty more meat trains to arrive yet. Notice that the first train is now empty—it has not taken many minutes to unload 1200 quarters of beef, wheel them across the platform to the waiting vans, and therein hook them up again. The doors are banged to, and the train hauled slowly out of the station. A gang is going to play house-afire with it now; when it gets to its siding, water from a hose will be splashed into all the corners of the vans and they will be scrubbed down. Did you notice their steel linings and concrete floors? Those vans must be kept sweet at all costs.

Isn't there anything besides meat? Of course there is—anything and everything. Look around you: wait, come along here—mind how you go, sir; these porters are short-tempered and say things—that's it, you have to skip about a bit. Now, what about breakfast? No, I don't mean the coffee stall, but your own comfortable, well-ordered, substantial, eminently satisfactory breakfast. You don't need to be told that fish

slow to learn that an egg's value depends on the fashion in which it is packed and sent to market.

Odd, is it not? Notice, then, that the cases of eggs you see here are all exactly alike in shape and size: each one contains the same number of eggs, so many long hundreds, clean and carefully graded and sorted; the egg merchant knows just how many eggs he is getting for his money, and how much they are worth, to a halfpenny, by testing one case. That is an advantage in which traders and consumers both share; but it is nothing to the advantage in which both share owing to the cheapness with which the shipping and railway companies can carry those cases of eggs, all exactly alike in size and weight. Look; this railway van is completely filled with such cases. Doubtless one of the steamer's holds was completely filled with them. What does that signify? This much: given the knowledge that you will, on a certain day, be called upon to handle, say, 500 cases of eggs (or anything else) of a given capacity and weight, you can estimate exactly what it will cost you to carry them a given distance. They will occupy so many cubic feet of space in the steamer, and you know what that costs. They will fill exactly a certain number of railway vans, and you know what that costs. It will need so many porters to handle the cases, it will take so much locomotive power to haul them to their destination, and you know what those things cost. Hence you know exactly what to charge the trader who wishes to send the eggs from somewhere to somewhere else. You know that the traffic is profitable, and you will do what you can to encourage it by



LOADING BANANAS IN COSTA RICA

Chap. IX

making things as easy as possible for those who want to buy eggs and those who have them to sell.

I have taken eggs as a typical commodity, to show you how it is that the foreign egg seller who always has eggs and sends them to us in the right fashion gets better terms for their transportation than the home egg seller, who is never quite sure whether he will have enough eggs to send anywhere, where he will send them, or when, and does not take the trouble to pack them properly. To show you still further what I mean—so that next time you read in the newspaper how unkind are our railways in giving better terms to foreigners than to home producers, you may know something of the rights of the matter—let us peep into the two vans that stand here side by side. In this one is cheese—from Canada; note that the cases fill the van. And in the neighbouring van is cheese also; good English cheese from Cheshire. Yes, you may well look surprised. *The Cheshire cheeses are not packed at all!* The cheese-maker or merchant, or whoever has sent them, failed to see the sense of paying the railway company for the carriage of a few extra pounds weight of packing. His cheeses cover the floor of the van, and no more. If he had piled them on top of one another they would, of course, have spoiled. Yet neither can the railway company put anything else on the top of them; so they have had to haul a van of 10 tons capacity with, say, a tenth part of its full load.

I dare say the man who sent the Cheshire cheeses has to pay almost as much for their carriage as the man who sent the Canadian, though there are eight

or nine times the quantity of the latter. True, the rate for carriage is estimated at so much a ton, but the charge is a great deal higher for a ton of cheese that has to travel on the floor of a van than for a ton of cheese that can share a van with other tons of other cheeses. It seems a very curious thing that the average British producer cannot see that it costs proportionately less to haul ten tons of produce than a ton or half a ton.[1]

Have you seen enough food? I can show you truck loads of market-garden stuffs that were growing yesterday in Bedfordshire, Cambridge, and Huntingdon; or vans and all sorts of odd vehicles—even obsolete third-class carriages—laden with thousands of baskets of strawberries; but enough! Let us get away from the smell peculiar to our city's exuberant dietary.

Outside the sheds the scene is more beautiful but no less busy. These are the marshalling and sorting yards, where the goods trains are made up and the thousands of wagons composing them marshalled in their proper order, so that they can be dropped off the trains at their destinations without unnecessary waste of engine power in shunting them. A kaleidoscope of trade is here. Tarpaulin-covered railway trucks, ugly enough in themselves, are made subtly beautiful in this great yard with its miles of movement. See

[1] It must be added, in fairness to those parts of the United Kingdom, and particularly of Ireland, where improved methods of collection and packing have been adopted under the co-operative principle, that it has lately been realized that the power of lowering railway and steamship rates is very largely in the hands of the producers and their agents. These can help the carriers to lower the cost, to them, of handling and carrying the commodities.

them pass and pass again—a never-ending procession—under the mauve-red of the arc lamps; watch their shadowy bulk harden as they draw into the light, grow distorted a moment, then dwindle again to fantastic shadows as they drop into blackness beyond. Catch the rhythm of their song as the countless wheels click-click over the rail joints—a song of all the crafts of earth. There is music to-night in this ever-waking corner of our sleeping city. There is a power in these sighing lamps to soften the rude shape and to mellow the harsh sound; and the clang of many buffers, and the whimpering of a dozen engines, and the shouts of the workers are made mysterious by an everlasting echo, like a rough voice in a cavern of many chambers.

Yes, there is a glamour in this great goods yard, this mighty giant that slaves to keep us fed and clothed, but a glamour that is only for the looker on. The giant is cruel, wickedly cruel, ruthless of life and limb, unheeding of a widow's sobs or an orphan's wail. How many times has an awful scream ascended to the black sky above this yard? How many times have brakes ground and tires skidded on greasy rails, while whistles sounded their appeal for help? How many limbs have been torn from their sockets, how many mangled shunters lifted by skilful hands to the grim stretcher? Alas! Our daily bread costs us dear in the price of men's lives, one way and another. The railway authorities do all they can? Yes, of course they do, being humane creatures like the rest of us, and valuing a servant's work above his widow's pension. The fault, if fault there be, is ours, not theirs.

You remember that that great man, Richard Trevithick, made the first locomotive ever seen in Great Britain. That was in 1804, in which year it successfully hauled a train on a tram road at Pen-y-Darren, near Merthyr Tydvil. There is one strange circumstance about the story of the locomotive that is worth mentioning here, because I do not remember to have seen it mentioned in its proper light elsewhere. It is this: that if it had not been for the betting proclivities of the age in which he lived, Trevithick might not have troubled himself to give the world the great gift of the railway locomotive.[1] Of course the locomotive would have come sooner or later—if not from Trevithick, then from some other inventor; but it is, I think, a fact that it was owing to two bets that Trevithick was encouraged to build an engine that was specially adapted to work on a railway. When he was in London in 1802, exhibiting his steam coach, wagers were being laid on the load that a single horse would be able to draw on the Surrey Iron Railway, a tramway that was then being built from Wandsworth to Croydon. "Ho, ho!" thought Trevithick; "I'll show 'em what *my* horse can draw." And he set to work, straight away, to build a railway locomotive. He found a prospective purchaser for this engine in a certain Mr. Humphrey (or Homfray), who had a bet with a sceptical friend. The sceptical friend said the engine would not draw a load of 10 tons over the 9 miles of tram road from Pen-y-Darren to Merthyr

[1] The betting craze of to-day is as nothing to the betting that went on at the end of the eighteenth and the beginning of the nineteenth centuries, when men laid wagers, not only on "sporting" chances but even on the most trivial incidents of daily life.

Tydvil. Mr. Humphrey won his bet; Trevithick saw to it that he did not lose. The engine hauled the stipulated load of 10 tons for the required distance, and about seventy men into the bargain.

It was the success of Trevithick's locomotive that really laid the foundation of the railway. You must understand that the railway itself, i.e. a track on which vehicles run, is a very ancient institution. When collieries began to develop in the north country, about the beginning of the seventeenth century, it became the fashion to lay down wooden "tram lines" over which the cauldrons were hauled to the nearest river staith. At a later date the wooden lines were shod with iron, and eventually became superseded by cast-iron rails, of one pattern or another. But, though these lines were satisfactory enough for the light wagons drawn by mules or ponies, they were not strong enough to withstand the weight of locomotives. On this account Trevithick's locomotives were put on one side as useless for practical purposes, and were set to work at pumping mines or winding. The great inventor had a great many irons in the fire, and when he found that nobody wanted his locomotives he turned his attention to other things.

George Stephenson's is the name we most often associate with the birth of the railway system. He is very properly called the "father of the railway system"; it was, in a very wide sense, the child of his genius and his indomitable courage. I have seen it seriously written that he was the inventor of the railway—this, too, in a school "reader"; of course he was nothing of the sort. The railway is not an invention of any

one man, but an agglomeration of inventions of many men and many periods.

The first public railway[1] worked by locomotives was, as you know, the Stockton and Darlington line, built by George Stephenson and opened in September, 1825. That seems a long time ago, and yet there are people living now who were alive when "the immense train of carriages" (amounting in all to about eighty tons weight) drawn by Stephenson's engine, "Locomotion", arrived at Darlington for the first time, and the railway was declared open for public traffic. The engine, "Locomotion", is historic on that account, but it was not the first locomotive built by Stephenson, neither was it altogether successful. As a matter of fact, prejudice against "travelling engines" was so strong in those days, and their advantages over horse traction were so doubtful, that the promoters of the Stockton and Darlington Railway had no intention of using them when they obtained their Act in 1821. This Act said that "Any person is to be at liberty to use and run a carriage on the railway provided he complies with the by-laws of the company". This sounds strange to our ears, but it was simply following the practice of the turnpike trusts and canal companies. It was not until 1833, when the line had been working for eight years, that the railway company took over the whole of the vehicles on the line, and a stop was put to the running of them by independent persons. The goods

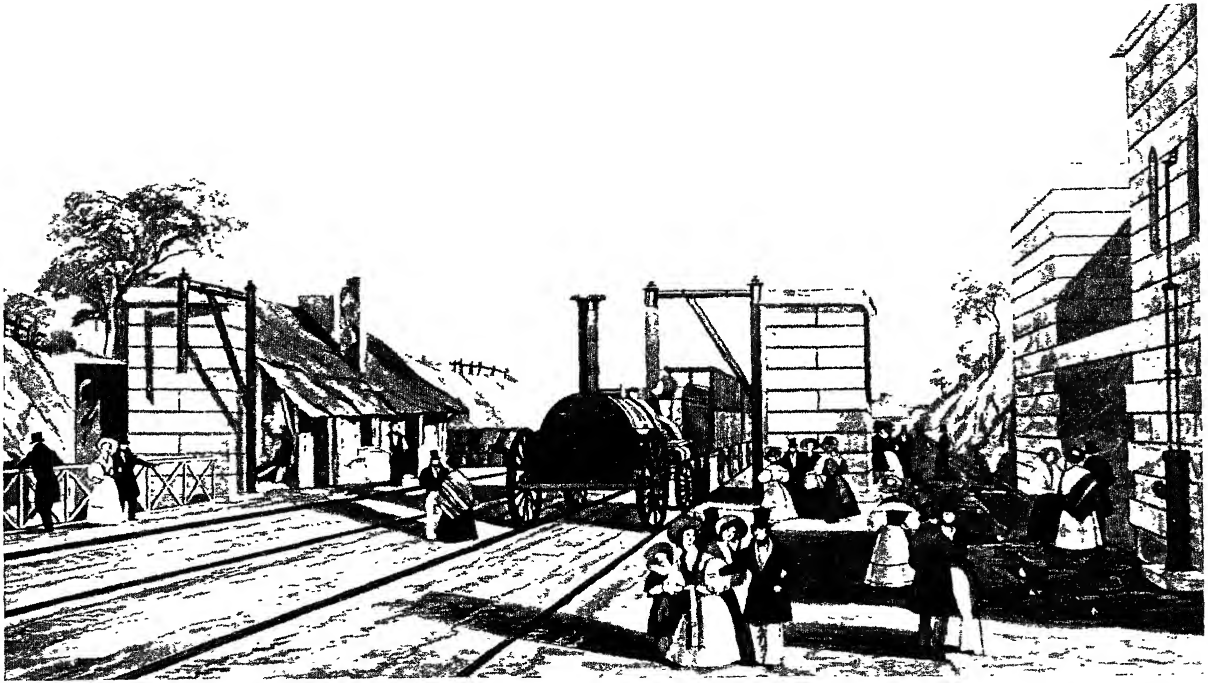
[1] Strictly, the first Railway Act was that of 1801, authorizing the construction of the Surrey Iron Railway already referred to. This Act provided that traders were to be free to use their horses and wagons on the line, subject to the payment of the stipulated tolls.

and mineral traffic was mostly worked by Stephenson's locomotives, and, where there were steep inclines, by fixed winding engines; but the passengers were carried in stage coaches mounted on suitable frames and wheels.

The line was single, with occasional refuge sidings, or passing places, and it frequently happened that two passenger coaches, or a coach and a goods train, would meet at a spot where one or the other had to retire to the nearest refuge. We may be sure that neither party would give way to the other without a great waste of argument and expostulation, in the days before there were timetables, and when there existed no definite regulations governing the "rule of the road". Occasionally, when the coaches met, the occupants would get down and fight it out, the vanquished party having perforce to travel back to the siding, while the victors followed, elated, but probably out of breath. There must, indeed, have been a spice of adventure about the new mode of travelling, though it had a drawback in its uncertainty, and was no more comfortable than the stage coaches on the roads. Yet it "caught on" amazingly, and the earliest passenger trains were well filled. We are told that the passengers were not at all particular where they rode. They crowded the coaches on the tops, the sides, or any part where they could get a footing. They frequently tumbled off, of course, but that only added to the fun, and as the speed was not more than 8 or 9 miles an hour, I do not suppose they were much the worse for their tumbles.

As I have said, the locomotive was regarded with

disfavour by all but a few enthusiastic men who saw in steam the germ of a power that was bound sooner or later to revolutionize transport on land, as it was already beginning to do on water. For the most part locomotives were objects that inspired the most intense hatred, and even as late as 1829 Parliament granted the Newcastle and Carlisle Railway Act only on condition that no engines should be used on it. "No locomotive or moveable steam engine" (says this Act) "shall be used on the said railway for drawing wagons or other carriages, or for any other purpose whatever; and no steam engine shall be erected or used for any of the purposes aforesaid, within view of the Castle of Newcastle, or Corby Castle, or of the several mansion houses of Charles Bacon, Esq., at Styford, John Hodgson, Esq., at Elswick, &c."—and then follows a long list of landowners who had been successful in persuading Parliament to protect what they were pleased to call their "rights", and by so doing to perpetuate the "wrongs" of the less fortunate. The whole story of the early days of the railway is a sad and sordid one—sad, because it illustrates our national inclination to resent changes and innovations rather than to welcome them. We are slow to learn and slow to adapt ourselves to altered or altering circumstances. Our grandfathers and great-grandfathers did not say, "We will see whether there is anything in these newfangled ideas—good may come of them", when railways were put before them; they *would not* echo Edward Pease, the leading spirit in the Stockton and Darlington Railway, when he said, with foresight that would show him to have been a really great



A RAILWAY STATION OF EIGHTY YEARS AGO

An old print of Rainhill Station, on the Liverpool and Manchester Railway. It was here that the famous locomotive trials were held in 1829, when Stephenson's "Rocket" carried off the prize of £500.

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man, if nothing else did: "Let the country but make the railways and the railways will make the country". What they did say was: "We hate *the idea* of these railways, and we *will not* have anything to do with them". Here is an extract from a responsible paper of 1835, which is typical of the attacks that were made upon railway schemes at this period:—

"Does anybody mean to say that decent people, passengers who would use their own carriages and are accustomed to their own comforts, would consent to be hurried along through the air upon a railroad, from which, had a lazy schoolboy left a marble, or a wicked one a stone, they would be pitched off their perilous track, into the valley beneath; or is it to be imagined that women, who may like the fun of being whirled away on a party of pleasure for an hour to see a sight, would endure the fatigue, and misery, and danger, not only to themselves, but their children and families, of being dragged through the air at the rate of 20 miles an hour, all their lives being at the mercy of a tin pipe, or a copper boiler, or the accidental dropping of a pebble on the line of way?

"We denounce the *mania* as destructive of the country in a thousand particulars—the whole face of the Kingdom is to be tattooed with these odious deformities; huge mounds are to intersect our beautiful valleys; the noise and stench of locomotive steam engines are to disturb the quietude of the peasant, the farmer, and the gentleman; and the roaring of bullocks, the bleating of sheep, and the grunting of pigs, to keep up one continual uproar through the night

along the lines of these most dangerous and disfiguring abominations.

"Railroads will, in their efforts to gain ground, do incalculable mischief. If they succeed they will give an unnatural impetus to society, destroy all the relations which exist between man and man, overthrow all mercantile regulations, overturn the metropolitan markets, drain the provinces of all their resources, and create, at the peril of life, all sorts of confusion and distress." There was a pretty forecast of the evils that were to come to pass in the day when railways should be general! Nothing, mark you, about the advantages that *might* accrue to the community. It is quite evident that the writer could find no good to say of it; it was not like the curate's egg—good in parts—but wholly bad, and so to be condemned with an unequivocal pen.

The popular antagonism was not, by any means, the worst feature of the birth and upbringing of the railway system. It is impossible to harm a good thing by hating it; and when at length the Liverpool and Manchester Railway had fought its way to completion, and George Stephenson's "Rocket" had completely vindicated the powers of the locomotive, it was useless for people seriously to set their faces against an innovation that immediately proved itself to be a blessing beyond the vista of the liveliest imagination. However much the good folks of 1830 may have resented the appearance of the locomotive, soon they had to admit that its character was less black than it had been painted. The boilers did not burst—at least, not often—cows still gave their milk, horses,

instead of being no longer wanted, became more valuable, because there was more work for them to do. None of the evil prophecies came to pass; but instead farmers, traders, consumers—the whole community—found in the railway a magic conduit of prosperity that seemed to settle on all within its reach.

It was at this stage, when the railway was no longer a toy, but was showing itself a resistless giant with mighty powers for good, that the opposition to it became strongest. Every time you take a railway journey, or send a package by rail, you are paying rather more than you ought to pay. This is not due to any fault of the railway companies, but to the fact that they have to pay interest on vast sums of money which were spent years ago in obtaining the sanction of Parliament to build their lines, and to extortion by landowners. In no other country were railways hampered in the same fashion, or to the same extent. Parliament was of course quite in the right when it set out to protect existing interests against the onslaught of railways, but its machinery was cumbersome and grossly expensive. Millions of money were wasted in obtaining Acts. Thus, the South-Eastern Railway Company expended £82,000 before they could obtain the Act authorizing the construction of the line—this, mark you, before a rood of land had been purchased. This line was designed to run through a purely agricultural country, and was from its nature totally unable to bear this iniquitous burden—iniquitous less from the shareholder's point of view than from that of the railway user's. The cost of obtaining the Act for the Blackwall Railway, a little

line only $5\frac{1}{2}$ miles long, was £75,673, or at the rate of £13,758 a *mile*. Five companies were in the field at the same time for the construction of a line from London to Brighton. Only one Act was granted, of course, to only one company, but the total parliamentary charges of that particular fight over a line of railway of secondary importance amounted to £193,500. In one case, promoters of a railway spent £143,000 in trying to get an Act, and failed to obtain it after all. That sum would have built and equipped a good long line of railway. It goes without saying that our national industries have to bear sooner or later the brunt of such utterly unnecessary expenditure.

The prices which the railways had to pay for land were even more iniquitous, and it is difficult to forgive the landowners of the early part of last century for the burden they imposed on their country. Their attitude to the railways was: "If you want the land you must pay for it—at our price". And their price was, very often, a price extorted by methods of blackmail. Thousands of men were paid fancy prices for the land wanted for railways, in addition to what they were pleased to term "moral" or "consequential" damages[1], on the strength of threats that if the sums demanded were not forthcoming the owners of the land would oppose the railways and involve them in

[1] One landowner was paid £8000 for a plot of land and £10,000 as "consequential" damages. Instead of damaging the remainder of his property the building of the railway increased its value by 20 per cent. This landowner was less generous—or rather should one say less honest?—than the Duke of Bedford, who voluntarily returned £150,000 paid to him as compensation, when he found that the railway increased the value of his land instead of depreciating it.

long and tedious litigation. The Eastern Counties Railway was made to pay no less a sum than £120,000 for a parcel of land said to be worth then not more than £5000. Sometimes, however, the companies got the better of their oppressors. One man demanded £8000 and was paid £80. In another case the estate of a nobleman was near a proposed line. "He was proud of his park, and great was his resentment. In vain was it proved that the new road would not come within 6 miles of his house, that the highway lay between, that a tunnel would hide the inelegance. He resisted all overtures on the plea of his feelings until £30,000 was offered. The route was, however, afterwards changed. A new line was marked out which would not even approach his domain; and, enraged at the prospect of losing the £30,000, he resisted it as strenuously as the other."[1]

In some instances towns refused to have anything whatever to do with the proposed railways, and opposed their coming to such an extent that the lines had to be diverted in order to avoid them. Northampton, Maidstone, and Windsor are noteworthy, but not exceptional, examples. Of these Northampton is the most famous. It was proposed that the London and Birmingham Railway should pass through this town, but the inhabitants were so bitter against the railway undertaking that it was decided to avoid the town altogether; it was indeed a veritable hornets' nest, and there was nothing else to be done. The diversion of the line involved the driving of the Kilsby tunnel. This tunnel was one of Robert Stephenson's

[1] John Francis, *A History of the English Railway*, 1851.

greatest exploits, and its story is fully told in *Conquests of Engineering*. The tunnel cost £300,000, and delayed the opening of the railway for many months. This enormous expenditure was not in any sense necessary to the railway, but was forced upon the company solely as a result of the attitude of the duffers who dwelt in Northampton. What that town has lost by its shortsighted policy cannot be properly estimated, but the loss was certainly tremendous, for the original proposal was to build the locomotive and carriage works of the company at that place. Of course, within a few years of the opening of the line Northampton was crying out for a railway.

Do you ever read that bright little monthly magazine known as *Bradshaw's Railway Guide*? When I say read it I do not mean merely turning up a train, but studying its pages seriously, even if you do so with no better object in view than the plotting of imaginary journeys—though for the matter of that a journey on paper is the next best thing to a journey in reality; and if you care to try it when you have a loose half-hour at a railway station, I can warrant you will find the time not wasted. Joking apart, Bradshaw is a very wonderful book, from which he who reads may learn a vast amount of the history of our railway system—a fascinating history full of wonderful episodes and stirring adventures.

A recent writer on Canada has said: "Through its railways Canada lives and grows". Canada is not peculiar in that respect; the same thing might be said of any country, for it is true of all. But there is a romance about the great transcontinental railways of

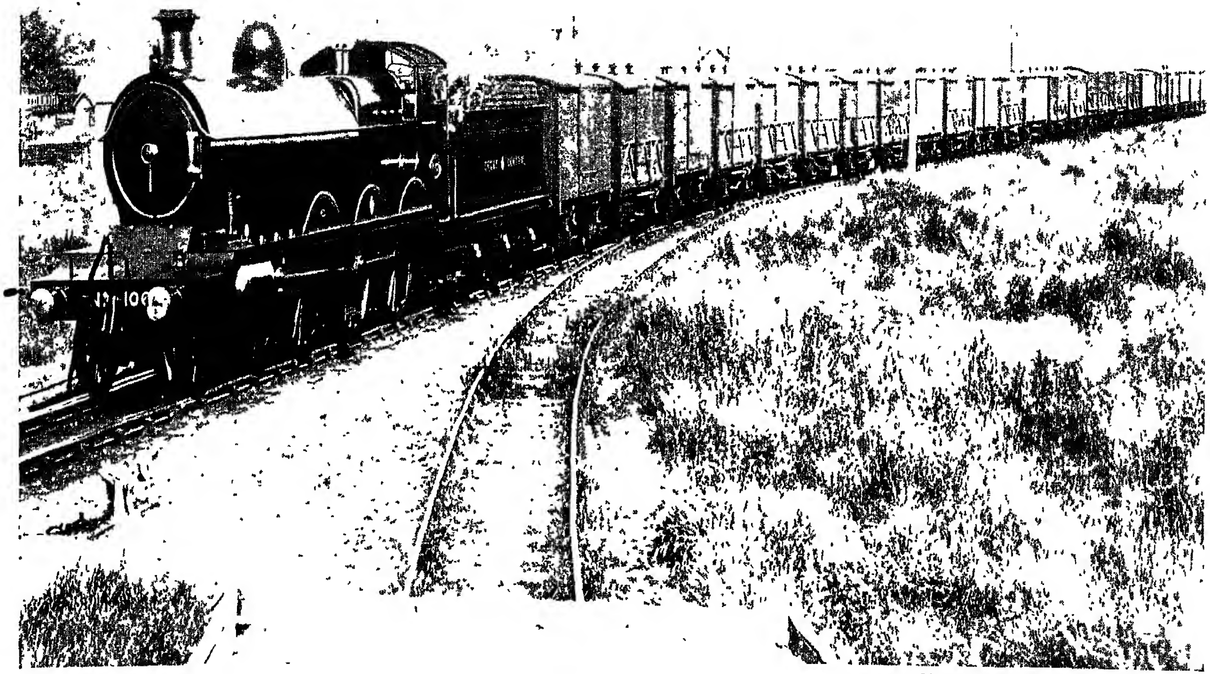
Canada that makes them appeal to us in a special sense. They are the biggest things in that land of big things. Take, for example, the mileage worked by the Canadian Pacific Railway—some 11,000 miles, shortly to be increased to over 12,000—and compare it with the 3000 and odd miles of our own Great Western system, the largest in the United Kingdom. The interests of this great Canadian system are so far-reaching as to stagger by their magnitude. Apart from the actual running of the trains and steamers, and the business proper to a railway company, the Canadian Pacific Railway has a great variety of other interests making for the prosperity of the country. There are the interests involved in the administration of the vast tracts of land given to the company by the Canadian Government—some 25,000,000 acres were so given; great schemes of irrigation, the result of an effort to make productive, in more ways than one, a section of country that would otherwise be an eye-sore on the company's main line. And apart from these there are great mining interests to be looked after—coal, copper, lead, and gold—the development of which, along with large tracts of timber lands, is in the hands of this great railway company.

The company provides a huge quantity of food, too, for the consumption of the patrons on its fine steamers that ply on the Atlantic, on the Pacific, on the Great Lakes and many rivers; in its numerous hotels and luxurious dining cars. In 1912 it served 10,000,000 meals, an average of about 30,000 meals a day, equivalent to the amount of food required by a town of the size, say, of Oswestry, allowing three meals a

day to each inhabitant. This great railway system, which embraces roughly five-elevenths of the total railways of Canada, operates over 19,000 miles of line; a thousand miles more than the combined route mileage of the three largest British systems, the London Midland and Scottish, the London and North-Eastern, and the Great Western. In 1925 the Canadian Pacific Railway conveyed 13,695,633 passengers, 263,462,000 bushels of grain, and a total of 31,090,504 tons of goods. The Canadian Pacific Railway provides the longest through route under one management in the world, and claims as its termini Liverpool and Yokohama, the journey between these places occupying three weeks. The main line of the railway from the Atlantic to the Pacific is 2895 miles long. It was completed in 1885.

All the same, the company has had to pay dearly for this hurry in construction. The line was thrown down as hurriedly as supplies could be brought up, and vast sums have since been spent on re-alignment, in order to avoid severe gradients, especially in the Rocky Mountains. The great object of railway builders nowadays is to obtain as level a line as possible. It costs less to haul a train over 10 miles of level road than up a single steep hill, perhaps less than 1 mile long.[1] George Stephenson realized this, but very few of his contemporaries did. Early rail-

[1] To show more clearly what is meant it may be said that an engine capable of hauling a train of sixty loaded wagons, weighing, say, 900 tons, on a level line at a speed of 30 miles an hour, will only be able to haul half the load up an incline of 1 in 100, and a quarter of the load up one of 1 in 50. Of course this is not a hard-and-fast rule, for special types of locomotives are now built which are capable of dealing with heavy loads on any average road.



Photo, Locomotive Publishing Company

AN EXPRESS TRAIN TAKING PERISHABLE GOODS TO MARKET

way engineers, and some very famous ones too—Brunel is an example—aimed at building a direct road, and took their lines over hill and down dale rather than incur the expense of heavy engineering works, such as big bridges and embankments, long tunnels, and deep cuttings. This was a policy of false economy, though the engineers were not wholly to blame; and there are stretches of railway all over the world on which huge sums have been spent on reconstruction works with the object of lowering operating costs. At a moderate computation the money already spent throughout the world on railway reconstruction might be put at £400,000,000. It is probably much more; and half of this sum, at least, must have been spent already in America. And as yet only a beginning has been made! Indeed, a railway magnate, Mr. E. H. Harriman, has said that practically every railway in America will have to be rebuilt. The Canadian Pacific Railway provides a very famous example in the line which runs through the Kicking Horse Pass.

Kicking Horse Pass is one of the few gaps through the great barrier of the Rockies that have so far been utilized for the lines of communication running from east to west across Canada. As I have said, the men who built the Canadian Pacific Railway took the first trail they could find. They were a long time in finding it; again and again they sought for the way through the great mountains and failed. But at length the Kicking Horse Pass was explored and found to afford a feasible route for the railway, though not by any means a desirable one, since it involved

a steep ascent. Over this hill, however, the railway had to be carried. From the first it became known as the Big Hill; but when the railway was young and the traffic light, an ascent more or less was of small account. It was not until the whole service was speeded up, and trains grew faster and heavier, that the 4 miles up the Big Hill really became a thorn in the side of the authorities. Trains going up needed extra assistance from four or five locomotives, which pushed behind; trains coming down sometimes ran away and were derailed; and it became obvious that the line must be re-aligned so as to secure easier gradients. The engineers set to work to see what could be done, and they followed out a plan which cost the company a quarter of a million sterling, though it only entailed the building of 8 miles of new railway line. They doubled the distance up the Big Hill, but by so doing they halved the gradient. They made the line wind round and round, doubling back upon itself, corkscrew fashion. To do this they had to cut two spiral tunnels, similar to those on the St. Gothard Railway.

The debt that the world owes to the railway pioneers can never be told. The work they have done in civilized countries, with all the means for overcoming obstacles ready to their hands, is a sublime monument to their courage and faith which all can see and admire. But harder work has been done in opening up the dim and distant corners of our own and other empires, in letting in the light of civilization, and all that the word means to us, upon savage and little-known countries. New grist comes every day to our

country's mill as a result of the railways that brave men are always pushing across deserts and plains, through jungle and swamp. I was reading not very long ago an account of the West African Government Railways,[1] and as I read I wondered that nobody had thought it worth while to write the history of the amazing adventures of Sir William Shelford and his colleagues. These men were empire builders in the best sense; and the fact that the railways that they drove into the forests of the Gold Coast and Southern Nigeria are now unable to cope with the traffic is due only to the sensational development of the resources of the West African hinterland, as a result of the railway expansion. The trials and troubles that the builders of these railways had to endure would provide a misanthrope with several hours' good reading.

The troubles began at the very beginning. In one case—that of the Gold Coast Railway—the party of surveyors that had been sent into the dense bush to mark out the route of the line fell victims to malaria. One man died, and the survivors crawled back to the coast broken men. Much valuable plant and still more valuable stores were lost while they were being landed in the heavy surf that always prevails off Secundee. These, however, were slight accidents compared with those that marked the construction of the railway. The greatest setback to the work arose from the denseness of the great forest belt that stretches inland for about 150 miles. The

[1] Being a paper read in 1912 by Mr. Frederick Shelford, before the Institution of Civil Engineers.

railway builders were prepared to face all risks, and the unhealthiness of the climate had small terrors for them, though the forest abounded in stagnant swamps, on which swarmed malaria-carrying mosquitoes. Thanks, however, to Sir Ronald Ross's great work, explorers are now able to invade tropical countries armed with a surer weapon than rifle or shot-gun—a knowledge of the habits and customs of the mosquito; and therein lies their safeguard.

It must indeed be disconcerting to a railway engineer in the Tropics to discover one fine morning that the pegs he has driven into the ground to mark the centre line of his track have sprouted and developed into fine healthy trees, so that he cannot find them again—as pegs. That was what happened in West Africa; and I have no doubt that the surveyors who had to survey the same route over and over again had some very harsh things to say about the warm, moist condition of the atmosphere. Another effect of this good growing weather, as a farmer would call it, is to make it impossible to clear the bush much in advance of the construction gangs, for the simple reason that a clearing is overgrown again almost immediately. The greatest difficulty experienced in the building of the West African lines, however, arose from the falling of trees on to the lines. All trees which might fall and damage either the railway or the telegraph lines had to be cut down. As the trees commonly reached a height of 150 feet, it became necessary to cut a roadway 300 feet wide in addition to the width of the railway. The area actually cleared represented about 40 acres to a mile of

line, and there were about twenty really large trees to the acre, as well as smaller trees and undergrowth. This represents an average of 80,000 trees to be felled in 100 miles of railway. Steam tree-felling machinery was tried, but was found to be less satisfactory in the hands of the native labourers than axes and saws. "Some of the trees met with in the West African forests are very large, measuring 20 to 30 feet in circumference at the base and furnished with large buttresses. Such a tree will take two or three days to cut down. . . . The tree when felled is by no means disposed of. It has to be cut into sections and rolled aside. The very large mass of small branches, as well as the undergrowth, has to be cut up, dried, and burnt. The stump of the tree also causes difficulty. It has to be dug round, the roots have to be cut, and the stump must be dragged out and hauled aside, unless its position is such that it can be allowed to remain."

The builders of the Uganda Railway were beset with dangers from wild beasts. At one point, where a bridge had to be constructed over the Tsavo River, two man-eating lions caused such dreadful depredations that panic reigned in the construction camp, and it was impossible to progress with the work. The story of how the lions broke into the camp night after night is thrillingly told in a book called *The Man-eaters of Tsavo*, by Lieutenant-Colonel Patterson, the engineer-in-charge. Colonel Patterson eventually succeeded in shooting the man-eaters, but not before they had devoured, between them, no fewer than twenty-eight Indian coolies employed on

the bridge work, in addition to scores of unfortunate African natives of whom no official record was kept.

You remember the geographical position of Peru, how it is shut off from all communication with the rest of the continent of South America by that great wall of mountains, the Andes. Although to-day Peru has fallen upon evil times, it was formerly in a very prosperous condition, with a flourishing trade in guano and nitrates. The difficulty was its isolated position. Ships from the Old World had to go round Cape Horn, a dangerous and much-dreaded voyage, and it was with the Old World that the principal trade was done. To avoid this long journey a Philadelphian, Henry Meiggs, started upon a very daring railway project. This was nothing less than to run a railway right over the Andes, and thus connect the seaport of Callao with the River Amazon. It is a wonderful feat to build a railway over any mountain range, but the difficulties presented by the Andes were colossal. The Andes are unique amongst mountains for the depth of their ravines and the precipitous nature of their cliffs. In some places there were dizzy ledges along which the railway line was laid; more often there were none, and Meiggs had to blast away the cliff, or pierce the mountain with a tunnel. It is said that he used a million pounds of explosives every month. The line is only 136 miles long, but it cost the huge sum of eight and a half million pounds.

This line, the Peruvian Central Railway—more commonly known as the Oroya Railway—has the distinction of being the highest in the world. Apart from the visible obstacles in their way Meiggs and

his men had other foes far more terrible. Of course they suffered from mountain sickness. The summit level of the line is 15,645 feet above the sea, and this was only to be expected. The most terrible feature of the effort was the building of the bridge of Verrugas. This bridge crosses a deep gorge, and large numbers of workmen were engaged upon it, because the building of the line could not proceed until the bridge was ready to carry materials. All at once a fearful sickness attacked the workmen on the bridge, a swift and deadly sickness for which no cure could be found, because no one knew what it was.[1]

Hundreds of men died, and most of those who were fortunate enough to escape fled from the spot. The bridge was at last completed by bands of adventurers, tempted by the enormous wages offered. Many of them perished, but the work was achieved somehow. Meiggs himself was untouched by the fever, but the horror and misery of the pestilence completely broke his spirit. He died soon after, seven years after the beginning of his great scheme, having brought the line as far as Chicla. Nothing more was done for fourteen years, when another Philadelphian, William Thorndike, was engaged to carry on the work. His finest achievement was the driving of the Galera tunnel, nearly 4000 feet in length, through the summit of a mountain. From this point the line was quickly carried down to Oroya, which at present is the terminus.

[1] The sickness is now supposed to be due to something in the water of the Verrugas. A recently published guidebook informs its readers that no harm will come to them by passing through the district, but recommends them not to linger in the valley!

Meiggs's masterpiece—the Verrugas bridge—was destroyed by a flood in 1889, and was replaced by a slender-looking structure which was completed in 1891. The largest of the three spans of the new bridge is 580 feet wide, and spans the forbidding gorge at a height of 250 feet.

The Oroya line is not the only one over the Peruvian Andes, for the railway which runs from Mollendo to Lake Titicaca crosses them at an altitude of 14,600 feet. Next to this line, in point of altitude, comes the Arica–La Paz Railway, the latest of the mountain railways of South America. It runs from Arica, on the Pacific coast, to La Paz. If you are well up in geography you will know that La Paz is a very remarkable city. It is the capital of the department of the same name in Bolivia, and is built on a plateau in the Andes which stands nearly 12,000 feet nearer the sky than London. The people who dwell in La Paz enjoy a salubrious air, and are content to lead a simple life in mud houses; but they are not without the amenities of civilization, since they boast of their progressive medical college, and claim to have one of the most magnificent cathedrals in South America. It seems odd to me that these queer people—people must be queer when they live in a city which is under snow for five months of the year and under cloud for the remaining seven—should live in touch with the most wonderful railway that the genius of engineers has yet devised. Such is the Arica–La Paz Railway, however, surpassing all in its magnificence of design and the consummate skill with which the contrac-

tors, Sir John Jackson, Ltd., hurled themselves at the forbidding Andes, and conquered them in a short and sharp campaign of three years. They cared nothing—or pretended to—for yawning chasm or mountain torrent, for blizzard or avalanche. They took their rails and carried them over the Andes, choosing for this feat a point where the mountains are only 14,000 feet high. Thus this line actually crowns the Andes, unlike Meiggs's line, and the others, which are carried through in tunnels. The gradients are so steep that instead of ordinary rails the rack system is employed for more than 25 miles, and the engines crawl up and down tooth by tooth, as do the little train that runs to the summit of Snowdon and those you may have seen in the Swiss Alps if you have ever been lucky enough to have the chance. The bridges, however, constitute the most remarkable feature of the enterprise. As in the case of the Oroya line, immense gorges had to be crossed somehow, and as a rule the only possible method was by single-span bridges. The railway was completed in 1912, and I have no doubt that it is now sending down to the world copper and alpaca wool from the mines and flocks of the good people of La Paz.

The first transcontinental railway in South America was opened in 1910—opened throughout, that is; for in that year was welded the last link in the chain of railway communication between Buenos Ayres in Argentina and Valparaiso in Chile. This last link is a tunnel some two miles long, driven through the Andes at an elevation which is equal to rather more

than the tunnel's length, 10,000 feet. It belongs to the Argentine Transandine Railway, a line 111 miles long, which "connected" Mendoza, on the Argentine Great Western Railway, with Los Andes, on the Chilian Railways, by means of a gap in the lines, over which passengers and baggage were carried in wagons. This form of connection, or rather of disconnection, had its disadvantages. For instance, it was only available for six or seven months in the year, when the roads were not snow-bound; also, it was attended by a certain amount of discomfort, though I have no doubt that the excitement of the journey and the wonders of the scenery compensated for this. It is said that this "combination transport" coach service used to be the most efficient of the kind in the world. It was kept up at a cost of £8000 a month, which you will better understand when I say that *El Servicio Cordillera* comprised twenty coaches, ten baggage wagons, five hundred horses, and a hundred and fifty men, besides a guard of constabulary. A graphic account of the journey of the "combination transport" over the Cumbre Pass, 13,000 feet above sea level, was given by a writer in *The World's Work.*[1] From it I quote the following description, by which we gain a glimpse of the roof of the world.

"As the afternoon shadows began to creep into the valleys, the train (*from Mendoza*) drew up before some little corrugated-iron roofed buildings—near a few corrals—Las Cuevas, the Argentine end of the railway. Between the buildings and the train was

[1] "South America's First Transcontinental Railway", *The World's Work*, January, 1911.

a living mass of horses, mules, and men, through which a long line of the white-covered, broad-gauge coaches stretched on up the road.

"The scene was a fascinating one—a bit of Chile dropped over the border into Argentine; the flapping, varicoloured ponchos, jingling six-inch spurs, and small high-pointed saddle and saddle gear bespoke the Chilian, for such were the dark swarthy-visaged men who rode and drove.

"'Get in, please,' came a warning request. 'When we go, we go with a jump.' . . . A command, and like a flash 'the Combination' was off at a gallop—only ten minutes after the train had arrived with one hundred passengers and twice as many pieces of baggage. Along the mile-stretch of level road, with the pack-train in the rear, went the long string of coaches followed by the two baggage wagons; behind and scattered along the sides of the narrow coach route were mounted Chilians and some constabulary. A sharp turn and the zigzag climb began. Shifting to little side trails, which almost imperceptibly left the road, the pack-train and many of the mounted men suddenly disintegrated from 'the Combination', scrambling, turning, twisting, but ever carefully choosing each his own path up, over edges of the steep slope, and disappearing, to come again suddenly into sight farther up the mountain in a wholly unexpected quarter. . . .

"A coach horse suddenly bucks, lies down, kicks, balks, and an outrider's lasso jerks him into horse sense; the steep ascent at places is too great for the tired little animals of the heavy baggage wagons, for

'the Transport' has already made the trip over earlier in the day—so watch that *postillione.* Swinging by on the run, he dips from his saddle, deftly links in the hitch-hook—and now, five horses abreast, they spring afresh to their work."

We need not go to America to see mountain railways, or mountains either for that matter. Indeed, we can see quite a lot in this line in our own country. On a smaller scale certainly; but then bigness is comparative, and if you have never seen the Rockies or the Andes or the High Alps, the mountains of Great Britain will sufficiently impress you. As a mountain railway the rack line up Snowdon is a very insignificant thing truly, an engineering feat incapable of comparison with the railways of Oroya, La Paz, St. Gothard, or Jungfrau, so why attempt to compare them? You can be jerked up Snowdon at less cost and with less fatigue than up any other mountain in the world. You need only say to yourself as you go: "Geographers have made a mistake, this mountain is 13,600 feet high, not 3600", to be quite satisfied that you are really on your way to the summit of an Andean sentinel—I assume, of course, that you are hankering after the Andes. You would like to see the engineering marvels of the railways I have been writing about? Tut, sir, what would corkscrew tunnels and gossamer bridges be to you, cold and sick, a wretched prisoner in a bucking train? See the engineering marvels of your own country and the mountain regions of your own country before you pine for those of other lands. Then, when you have exhausted the wonders of the Festiniog Rail-

way, or the line that runs from Bala to Festiniog, or that from Craigendoran to Mallaig, or the Highland Railway—then, and not till then, will you be mentally fit to judge the sights of other countries.

So many big mountains have been conquered by the railway builder that the theme has lost its novelty, and people do not now gasp at it as they did a few years ago. The great mountain lines of which I have spoken so far have been constructed to noble ends: the bringing of distant peoples into touch with the busy world, the opening of new outlets for their industry and enterprise. Can as much be said for the Jungfrau Railway? Is the gratification of a tourist's curiosity to know what it feels like and looks like to be on a mountain top a sufficient excuse for the engineer's endeavour, or is it desecration of his own handiwork and of God's? As a work of engineering the Jungfrau Railway is sublime. As a work of utility it hardly seems worth the money and the time spent on it. As an example of careful calculation it is unquestionably deplorable. Its promoters thought that the line would take about five years to construct: it actually occupied in the building nearly four times as long. That was owing less to the engineering difficulties—great as they were—than to shortage of funds. The original estimate of £300,000 was nearly doubled before the work was finished. It is the highest railway in Europe. It will carry you, if you are lucky enough to give it the chance, to the summit of the Jungfrau, 13,669 feet above the sea.

Asked to name from among all the railways of the world the one which comes first in pure romantic

interest, I should hesitate between two—the pioneer of all railways and the Trans-Siberian Railway, the longest in the world. The main line of the Trans-Siberian, from Cheliabinsk to Vladivostock, is 4696 miles, but this is only part of its through all-rail connection. You can get on board a train at Ostend and stay in it until you are turned out at the terminus at Vladivostock—7300 miles from the starting-point. Eleven days on a train! On and on and ever on you go, through Belgium, or, if you prefer, through Holland, and then through mighty Germany, across Russia, and so on through a huge country of which most of us know practically nothing, beyond that it is a land of enigma: a land wherein we meet the strangest contrasts, great wealth and resources and absolute sterility; high civilization hand-in-hand with savagery; mighty cities on the fringe of mighty deserts; warmth to grow pomegranates and melons, and cold to kill every living thing. Such is Siberia, across which Russia has flung a girdle of steel. In the middle of it she has set up a board, on one side of which is written: "To the Atlantic Ocean", and on the other side: "To the Great Ocean". That board expresses the highest ideal of railway building. It is true that when Russia planned the line she thought little of the benefits its construction would bring to her neighbours in Europe and the Far East, and less, perhaps, of its importance to her Siberian domains. What the Tsar dreamed of when, on 17th March, 1891, he confirmed by his sanction the plans that his ministers laid before him, only the Tsar knew. But the ministers dreamed of a great military road to a great naval

station on the Sea of Japan, and of one day adding to their master's dominions a great oriental empire—a dream that was shattered in the making of recent history of the quarrels of nations.

If Russia has lost on one count she has gained on another and a better one. Her province of Siberia has shown itself to be a country of vast possibilities—a land of promise instead of a land of despair and desolation. The railway has banished its frown, the frown by which most of us recognized it not many years ago, and Siberia is to Russia to-day what Canada, the Cape, or Australia is to Great Britain—a great field of endeavour for the surplus population of the mother country. Siberia is a big country—larger than Europe—say about forty times the size of Great Britain; but it is only beginning to open its eyes, like a huge territorial infant. It will take it a long time to throw off its swaddling clothes, no doubt; but in the meantime its education has begun at the hands of merchant tutors from Germany and America, Belgium and France, who are already reaping the benefit of our own supine indifference to the commercial development of the child Siberia's mind.

The great Trans-Siberian Railway has a direct interest for all of us. The modern Genie of the Lamp having with magnificent impartiality scattered our interests all over the globe, he sends to us, from time to time, a letter from China or Japan, a letter on which are stamped the words *Via Siberia*. They are the modern rendering of the strange device "Excelsior". They mean the same thing—higher still; higher still

in man's ambition to conquer distance, to fight down the obstacles that impede the free and speedy passage of his merchandise. To him who can catch the message of those two words—via Siberia—what a wonderful tale do they tell! The man whose rubber stamp imprints *Via Siberia* on a penny letter achieves a mighty monument to the greatness of man. As he stamps for his wages he knocks a big lump off the distance between Japan and China at one end, and London and her sister capitals at the other end; a matter of twenty-four days in the first case and twenty-six in the latter. It takes thirteen days to reach Japan from London, and eleven to reach China, by railway, compared with thirty-seven days via Brindisi and the sea route.

The ministers of state who were responsible for the construction of the Trans-Siberian Railway set to work inspired by a laudable patriotism. The railway was to be all-Russian, built of Russian material with Russian labour and under the supervision of Russian engineers. Unfortunately, railways require something besides patriotism in their building, and this something—which happens to be the highest engineering skill obtainable, backed by unimpeachable financial resources—the Russians had not. The result was that they made a lamentable "mess" of things. But, after all, the errors that were made have since been rectified, so we need say no more about them. Indeed, for sheer luxury of travel, I very much doubt whether any railway in the world has attained such a pitch of perfection as that offered by the Trans-Siberian Railway to its international

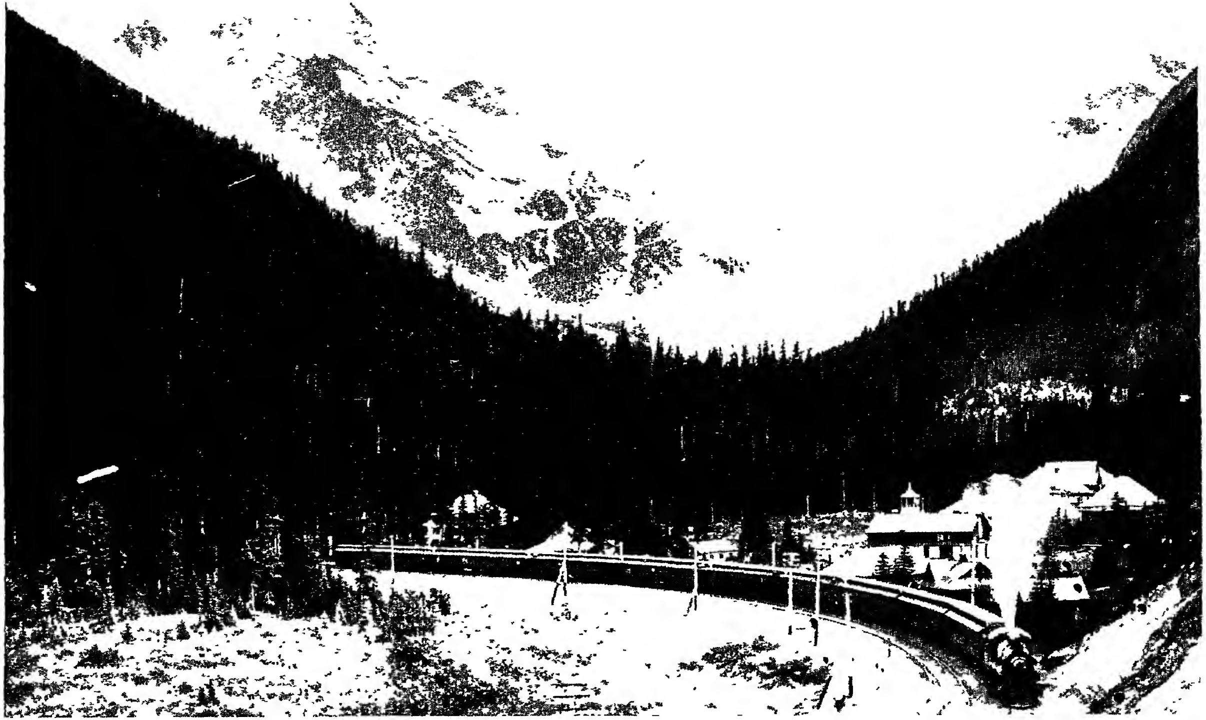


Photo. by courtesy of The Canadian Railway Company

C.P.R. TRANSCONTINENTAL EXPRESS AT GLACIER, BRITISH COLUMBIA

travellers. Since 1907 the International Sleeping Car Company's trains de luxe have been run direct to Vladivostock from Moscow, with a through connection every Monday from London, first-class only, London to Moscow. The trains are composed of first- and second-class sleeping cars, restaurant and baggage cars. The attendants generally speak French, German, English, and Russian. One conductor trained as a nurse forms part of the service, and is able to telegraph ahead for a doctor to meet the train at any station, if necessary. In one case an operation for appendicitis was thus successfully performed. Religious ministrations are not neglected, a clergyman being provided for Sunday services. The speed is comfortably easy, and the line is guarded throughout by soldiers. How popular is the Trans-Siberian route may be judged from the fact that in the season the full accommodation of the through service is booked up months in advance. There is some talk of providing a millionaires' train, composed only of first-class carriages of the finest description, and furnishing a separate compartment for each passenger. The first-class fare from Moscow to Vladivostock, including sleeping berth, costs about £35, 10*s*., which does not seem very much when the luxurious nature of the accommodation is considered.

"Overland to India" is a headline which we have seen in many newspapers during the last few years. That it will be possible to get to India by land—some day—is, of course, likely enough. At present, however, it must be confessed that the possibility is hardly likely to be realized yet awhile. The Trans-Persian

Railway, which would connect the railway systems of India and Russia, is now being considered by a *Société d'Etudes*, representing Britain, France, and Russia, which was formed in 1912. There is no doubt that they will report the railway to be feasible; but whether the different Governments concerned will be able to agree on concerted action is another matter altogether.

To most of us, probably, it is not the railway but the railway engine that appeals most strongly. The locomotive is such a magnificent creation that it thrills us by the mere suggestion of its power. Our grandfathers thought it diabolical; we regard it as sublime: and we are quite right to do so, for the locomotive of to-day is an amazingly efficient machine—that is, efficient as a locomotive; as an economical form of steam engine it still leaves a good deal to be desired. When you realize how surely and regularly train services are worked on any important railway, you can appreciate something of the reliability of the locomotive.

Some few years ago a well-known and much-respected locomotive engineer startled the world by the announcement that in Great Britain locomotives had practically reached the limit of size. But, lo and behold! locomotives are still growing, not conspicuously larger, perhaps, but yet larger, and more and more powerful in proportion to their size. Many times has the steam locomotive been threatened with extinction by rivals driven by petrol or electricity. It will not be conquered easily; and the hands that work the regulators of to-day will probably be stiffened in

death before the great machines they control cease to thunder their way wherever there is land to bear them.

Electric traction will come eventually, just as we shall fly eventually, or be able to see and talk to friends thousands of miles away; but the steam locomotive has a long life before it still. Electricians have yet to find more economical ways of generating and transmitting electricity before that mighty force will oust the steam engine from the field of long-distance haulage.

Who can tell what the future may not bring forth? There are forms of latent heat yet to be adapted to man's needs. And there are natural forces which we are now only beginning to probe. What of the heat of the sun? Or the power of falling water? Many a waterfall is already sending its thrilling song through miles of electric wire. The sun may help us further than he has yet done, not in his stores of wood or coal or water, but through the direct use of his rays. And the moon too; though dead she may yet help, and there is a scheme now on foot in Germany to make use of her hold on our waters. It is proposed to erect at Husum, at a cost of £250,000, a tidal power plant capable of generating 6000 horse power. If this scheme is a success—if the electric current can be generated more cheaply than from coal—it is quite possible that we may soon have to add another to the long list of the wonders of transport and that branch of it called electric traction.

CHAPTER X

The Conquest of the Air

Of all the discoveries and conquests that man has made in connection with modes of transport, there are few so romantic, so stirring, and so remarkable as his conquest of that invisible element which we call the air, and his triumphant use of it as a means of transport: romantic, because of the natural appeal which flight makes to the imagination; stirring, because of the adventures and perils connected with aerial experiments; and remarkable, because the history of flight differs considerably from the history of other scientific conquests made by man. It differs in one most important respect. In the history of most inventions theory and experiment are practically contemporary. But in the history of flight we find whole centuries of theory before we arrive, in comparatively recent times, at the history of practical experiment. The reason of this is, of course, not difficult to understand. We know to-day that the ability to fly presupposes a very considerable amount of scientific knowledge, and a vast array of engineering tools and resources. There is no doubt that flight has only been made possible by the discovery and perfection of the motor engine; and until the motor itself had been

sufficiently developed, the aeroplane, save in theory, was more or less out of reach.

In theory, however, it certainly existed in the minds of the earth's inhabitants from the earliest dates. Flight in its most graceful forms was everywhere visible to men, and they had daily examples of the use of wings in aiding birds to escape capture, and to cross unfordable rivers and impenetrable forests. In these circumstances it is safe to say that flight must have thrown some of its fascination over even the cave-dwellers; and many a hard-pressed fugitive or traveller, exhausted and footsore, must frequently have mourned the fact that man's crude mastery of the water, by means of his coracle, did not also extend to the air.

In later years we begin to find evidence that flight was dreamed of—evidence in legends, and in abstruse philosophic writings, only remarkable for the fantastic theories they expounded. There are the Greek legends of Perseus, whose winged feet are some proof of the fascination which the idea of flying was beginning to exercise over man; and there is the famous story of the aviator and inventor, Icarus, whose wings were fastened to his shoulders by wax, which was melted by the heat of the sun during an altitude flight! Though we may laugh at the story, it is at least possible that it is a distorted account of some parachute or flying-machine experiment that had been attended by fatal results.

Then come the dark ages, remarkable in the history of flight for the number of monkish treatises contributed towards the solution of the problem. As was

only to be expected in an age of alchemists and wizardry, these treatises consisted largely of wild theories, unsupported by experiment. Friar Roger Bacon, chemist and scientific thinker, wrote learnedly of a sea of air upon which the ponderous clouds overhead floated, and argued that once this sea was reached by human beings, they, too, could journey upon its invisible waves; he realized that the difficulty was undoubtedly to find the method of rising to this ocean, and for this purpose suggested the use of a hollow copper globe, extremely thin, and filled with liquid fire—an unconscious forecast of the balloon. Many years later, a monk named Lana made a somewhat similar suggestion, drawing plans of a boat lifted by four hollow globes, exhausted of air to make them light, and propelled by oars and a sail. In 1508 another monk, Damian, broke his leg in attempting to fly from the walls of Stirling Castle to France with the aid of artificial wings made of feathers; while Francis Bacon wrote a treatise explaining that the feathers of eagles "doe possess upward attractions" —a pathetic instance of a theory created by despair at the difficulty of the problem of flight.

One or two other friars and dreamers also threw out tentative hints as to the proper method of conquering the air, and in the year 1617 Fauste Veranzio actually proved that the air possessed a considerable power of support by descending from the tower of St. Mark's, Venice, in a parachute; and an English monk, Elmerus, followed his example in Spain. Some of the most remarkable writings and assertions were those of Bishop Wilkins of Chester, who foretold the

day when flying machines would be numerous, and would be propelled by steam engines.

Borelli, an Italian, attacked the problem in a more scientific and masterly way, by investigating the strength of the wing muscles of birds, with the idea of discovering, once for all, whether man was physically powerful enough to fly by his own exertions; and a somewhat similar method of investigation was carried out in 1678 by a locksmith named Besnier, who raised himself several feet from the ground by means of artificial wings, shaped like canoe paddles and strapped to his legs and shoulders. These were beaten up and down by powerful strokes, and gained their inventor deserved notoriety.

After this, for many years the problem of aerial transport remained unattacked in any serious way, and it was not until the year 1769 was reached that the history of flight left the main trunk of legend, dreams, and theory, along which it had grown for so many centuries, and branched off into two divergent directions. But in 1769 Sir George Cayley, by means of a simple model of whalebone, cork, and feathers, gave a practical example of the use of the screw propeller in flight—thus starting a new and vastly important line of inventive work, apart from that dealing with bird-winged machines. And not long afterwards—in 1782—the two brothers Montgolfier exhibited their paper hot-air balloon, and so created a new school of "lighter than air" theorists and inventors, whose minds were henceforth directed towards the improvement of the balloon. Shortly afterwards the research work of Cavendish, and of

Dr. Black of Edinburgh, made known the properties of the gas hydrogen. It was immediately employed in balloon work, and various daring investigators proceeded to make short aerial voyages, timidly at first, and then more confidently, quickly learning by experience the finer points of balloon construction and navigation.

From this time the practical history of flight may be said to begin in earnest, and concurrently with the vast growth of every kind of scientific knowledge the avalanche of invention gathered speed, and hurried onwards to its goal.

Henceforth, for the sake of clearness, and to avoid the frequent overlapping of dates, it will be necessary to consider the two branches of aerial invention separately, until we can combine them again under modern conditions, and show aeroplane and airship acting together in peace and war, after both had been extensively used in solving the problem of transport by air.

Space forbids a detailed description of the successive steps by which the balloon simple arrived at perfection. Suffice it to say that it very quickly attained its full development, and during all the years in which it has been in use it has been very little improved, and has undergone very little alteration.

Its shape was spherical from the first, for the good reason that the sphere will contain the greatest volume of gas in the smallest surface; and aeronauts quickly learnt to leave the neck of the envelope unfastened, for as the balloon rises the pressure of the air upon

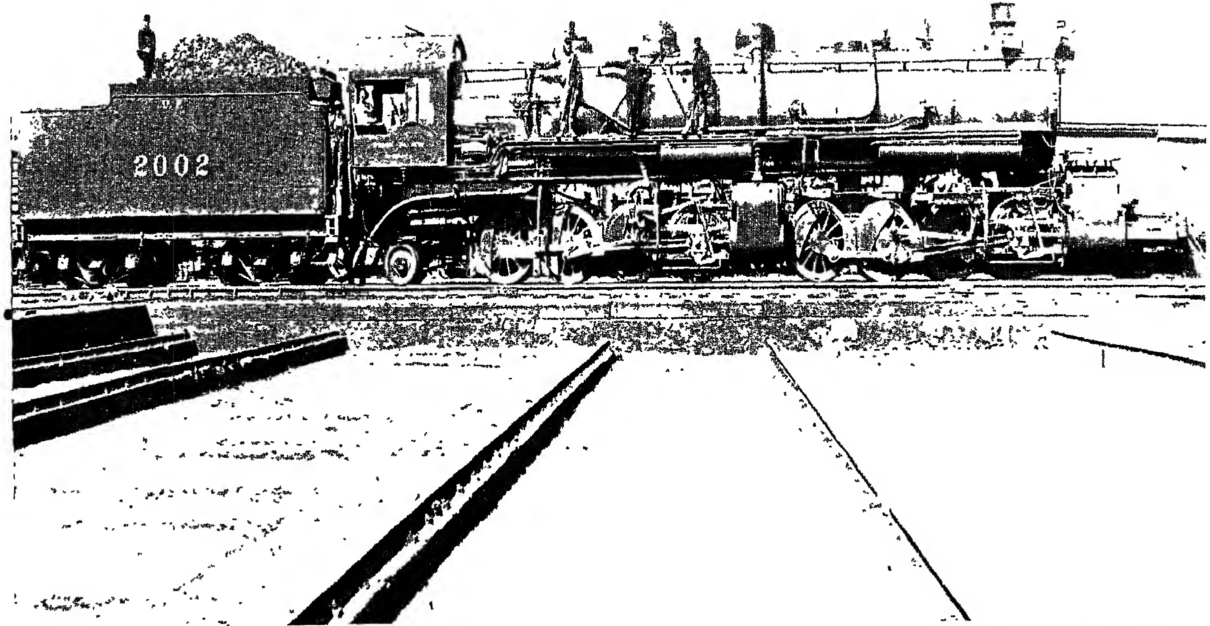


Photo Locomotive Publishing Company

AN AMERICAN LOCOMOTIVE GIANT

The huge machine here shown is a Mallet Compound Articulated Locomotive. Length over all 91 ft. 6 in. Each set of cylinders and driving wheels moves independently. Thus the giant can get round curves.

Chap. IX.

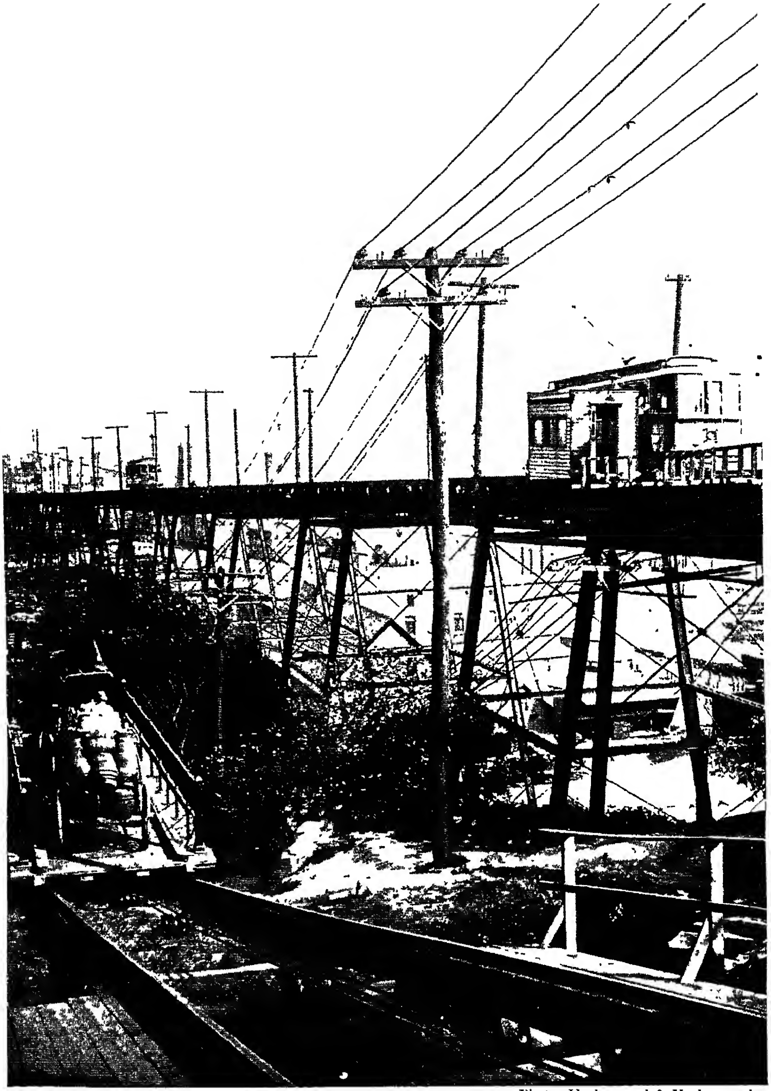


Photo Underwood & Underwood

THE HIGH-LEVEL TRAIN VIADUCT FROM THE LACKAWANNA FERRY TO JERSEY CITY HEIGHTS

In the foreground may be seen a lift for raising carts and wagons from the lower to the higher parts of the city. *Chap. IX.*

the envelope becomes less, allowing the gas within to expand and overflow, so that, were the envelope fastened hermetically, an explosion would be the necessary consequence of an ascent.

The open neck acts, therefore, as a kind of automatic safety valve; but as a further precaution a valve was soon fitted to the upper side of the envelope, so constructed that it could be opened at will by the pulling of a rope which descended into the car. A descent could thus be made when desired, the amount of gas released varying according to the wishes of the aeronaut, or the situation of the balloon. A further safety contrivance was furnished by the ripping valve, which consists simply of a silk band sewn along one of the seams of the envelope, to which is attached a cord, trailing downwards within easy reach of the aeronaut below. A tug at this rips the balloon, instantly releasing the volume of gas contained in the envelope, and allowing the balloon to be deflated in the least possible time, should it have landed in a gale, and lie in danger of destruction through being blown along by the wind. The ripping valve can also be used in mid-air, as was shown by John Wise, an American aeronaut; and as soon as the balloon begins to fall, the deflated envelope is forced to the top of the net by the pressure of the air beneath, and there acts as a parachute, checking the descent. Naturally, this method of descent was only used in cases of necessity.

In 1820 the famous English aeronaut Green added the guide rope to his balloon, and this long, spidery cable, which can always be seen depending from the

car of a free balloon, was at once adopted by aeronauts as a means of keeping the craft at a more or less constant altitude. The device acts automatically, the deadweight of the rope checking the balloon when it begins to climb, and the loss of weight checking a descent as soon as the balloon descends sufficiently to allow part of the rope to rest upon the earth below.

Such was the early balloon, and save for minor alterations, and the addition of improved scientific instruments of observation, it has been altered very little in modern times. The main points in connection with the navigation of the balloon, too, were quickly discovered. Gay-Lussac's law stating that gases are equally expanded or contracted by the variations of temperature explained why a balloon floating into a sudden blaze of warm sunshine at once began to ascend, and why a fall of temperature—the veiling of the sun by a cloud—instantly caused it to descend. It was also discovered that a balloon is so delicate a machine that the smallest loss of weight affects it in a startling degree, causing it to ascend to apparently disproportionate heights. Finally, owing to the expense of hydrogen, coal gas was substituted, and bags of sand were added as ballast, a certain amount of sand being thrown overboard from time to time to counteract the loss of buoyancy caused through the gradual leakage of gas. And equipped with this machine and this knowledge, man made his first experiments in aerial transport.

It should be noted, however, that from the first the impossibility of steering the balloon, or of driving it

against the wind, gave rise to a series of experiments and inventions in connection with the dirigible airship: so that as early as 1784 we read that the French brothers Robert constructed a fish-shaped balloon, to be propelled by oars; and in 1834 the Comte de Lennox built an airship with a cylindrical envelope, 130 feet in length, also fitted with oars, the manipulation of which was intended to drive the balloon faster than the current of air in which it was travelling, and thus give it steerage way.

Both these inventions were doomed to failure; and it was not until 1852 that a very notable airship appeared on the scene—the Giffard airship, cigar-shaped, and fitted with a 3-horse-power steam engine which drove a screw propeller. Some little success was attained with this craft, and in calm weather its course could be controlled by the use of a large triangular rudder; and although nothing further was done to the ship after its first few voyages, it is still notable as being the pioneer of the giant airships of to-day. At that time, however, attention was mostly centred upon the balloon, owing to the daring and initiative of the many famous aeronauts who made use of it. Ascents were frequently made at galas and fêtes, and the famous Vauxhall Gardens in London became the starting-place of many big voyages.

It is impossible to deal exhaustively with the innumerable ascents that were then made. We can only pick out a few of the landmarks of the history of aeronautics, and one of the first of these is the employment of the balloon in war.

and Coxwell, two very famous English aeronauts, whose voyages and escapes were innumerable. These two aeronauts, wishing to make scientific observations at a great altitude, actually ascended to a height of 36,000 feet, nearly seven miles. The experience, interesting though it was, had a terrible side to it. In the rarefied air Glaisher's sight became impaired, and his nose and ears began to bleed. He was afflicted with terrible pain, and his limbs became paralysed. He tried to struggle to his feet to check the ascent of the balloon, which was climbing steadily up, but he became unconscious; and Coxwell knew that it was imperative to reach the valve line in order to save the lives of himself and his companion. He, too, was nearly paralysed; his hands were frost-bitten and black, his fingers numbed, stiff, and useless; and he made the appalling discovery that the valve line had fouled in the big wooden ring above the car. It had to be released at all costs, and somehow or other, climbing with acute pain in the biting cold, and clinging grimly to the frozen ropes overhanging the immense abyss of space below, Coxwell struggled from the car to the ring, freed the line and, at peril of his life, dropped back. He landed safely in the car. A glance at his instruments showed him that the balloon was still ascending; and then he found that his hands were entirely useless. In desperation he seized the valve rope in his teeth, and by bending his head opened the valve above, and allowed a quantity of gas to escape. Shortly afterwards the balloon began to descend, and at length Glaisher recovered consciousness. Strangely enough, no last-

ing evil resulted from the effects of this courageous ascent. It must be remembered that the aeronauts had been unprovided with the oxygen cylinders which the modern aeronaut takes up; and in these days oxygen is usually taken at an altitude of 16,000 feet—less than half the height to which Coxwell and Glaisher rose. A few years later two French aeronauts were suffocated at an elevation of just over 29,000 feet, and only one of a party of three lived to tell of the experience.

From the time of the Franco-Prussian War to modern days, balloon ascents have been frequent in all parts of the globe. The Spencer brothers introduced the craft into India and China; the English army employed it in the Bechuanaland campaign; and in 1897 the Swede, Andrée, set out from Dane's Island, Sweden, in an ill-fated attempt to reach the North Pole by balloon. Two or three of his messages were picked up in buoys; but after that no more was heard of him, and it is certain that he perished somewhere in the icy, desolate regions of the North. In the Boer War balloons were frequently used for observation and range-finding purposes; and in 1906 the Gordon Bennett Challenge Cup was given for balloons travelling the farthest distance. In 1909 Colonel Schalk, of the Swiss Aero Club, made a trip lasting 72 hours, from Berlin to Norway; but the distance record is still held by Comte de la Vaulx, who, in 1900, travelled from Paris to Russia in 35 hours, covering a distance of 1193 miles; while in 1908 Mr. A. E. Gaudron travelled from the Crystal Palace to Mateki-Derevni, Russia,

traversing a distance of 1117 miles—the longest balloon voyage ever made from England.

Such is the general history of the balloon, the instrument by means of which man gained his first valuable experience of aerial travel. For the purposes of travel or transport its value, perhaps, was never very great, because of the impossibility of steering it in any desired direction. It is possible that its greatest value will be found to lie in the fact that its appearance gave a great impetus to aerial invention and discovery in other directions, and fired afresh the ambition of inventors actually to conquer the air in a machine that should not drift at the mercy of the winds and the caprice of the weather.

To the adherents of the balloon the problem of guiding such craft seemed simple. Having raised his car from the ground by balloon, the inventor had merely to furnish it with engines of sufficient power to drive a propeller, and by means of a rudder, or series of rudders, the balloon could be directed at will. In reality, owing to difficulties of construction, and weakness of engine power in machinery of light build, the problem was by no means easy to solve, and many were the ships built and experiments made before real success was attained.

At the start inventors differed upon the question of the most suitable engine. It is scarcely necessary to describe in detail the various airships which followed Giffard's. From the year 1872 there is a list of them—the Renard and Krebs, the Wolfert, the Tissandier, the Haenlein, and the Schwarz—all of them being only moderately successful, most of them employing different machinery for propulsion.

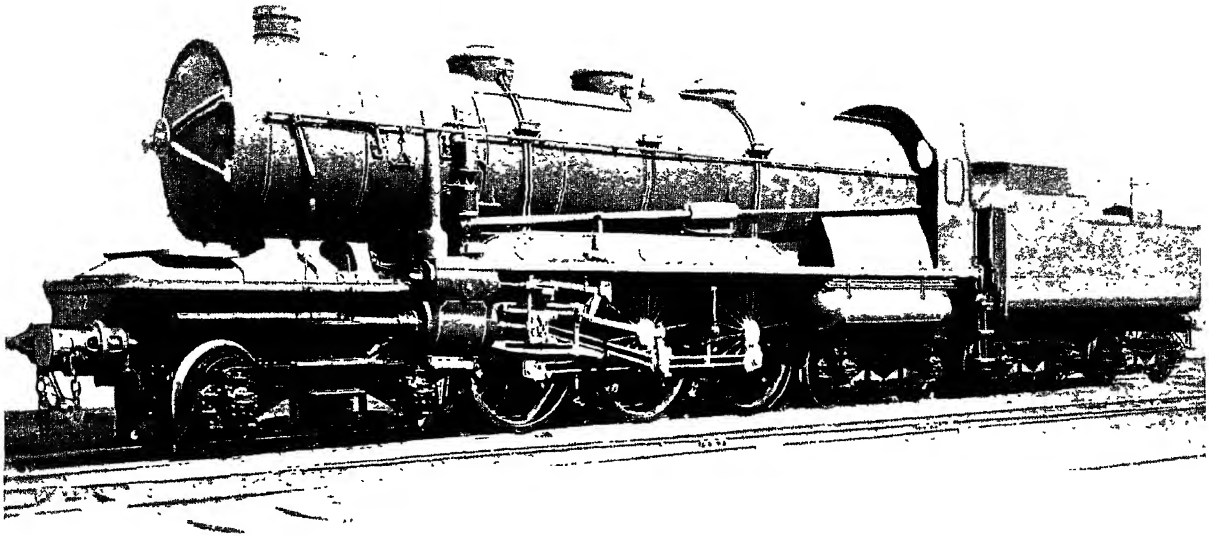


Photo Locomotive Publishing Company

FOUR-CYLINDER COMPOUND EXPRESS LOCOMOTIVE, NORTHERN OF FRANCE RAILWAY

A larger and heavier locomotive than is to be found in Great Britain. Its length is 80 ft. 11 in. over all. *Chap. IX.*

A Lenoir gas engine, an electric motor, a benzene motor—which set alight to the Wolfert airship in mid-air in 1887 and destroyed it, killing the inventor—were the various engines employed. Most of the ships were cigar-shaped, and all employed rudders; while the envelope of the Schwarz airship, which made its appearance in 1895, was built over a rigid framework of aluminium. But there was nothing specially remarkable about them, and the dirigible airship only began to attract the attention of the public when that enterprising Brazilian inventor Santos-Dumont made his appearance with a whole series of small craft in Paris. All were similar in appearance—a cigar-shaped envelope, a peculiar girder car beneath, and a tractor screw, with a big rudder astern. The difference between the units of the series was one of size, and of varying horse-power of the petrol motors which drove the screws.

In 1904, on Airship No. 6, Santos-Dumont won the Deutsch Prize by circling the Eiffel Tower, when a stiff breeze was blowing, returning safely to his starting-point at St. Cloud, the event marking an important advance in airship work. But, previously to this, Zeppelin Airship No. 1 had issued from her shed on Lake Constance, near Friedrichshafen, and her launch at once directed the attention of the public to the fact that there now existed three main types of airship, developed from the original balloon. This division into types still holds good; and as each type has its adherents it is as well to describe the fundamental differences between the classes.

The type which appeals most to the imagination is

that to which the famous Zeppelins belong—the rigid type. A ship of this class is less of a balloon and more of an aerial cruiser than her sisters of other types. She is frequently of immense size, and when aloft, glittering like a huge fish, with planes and rudders gleaming in the sun, and the tackle of the wireless apparatus swinging from her car—or rather, from her deck—she presents a stirring and magnificent spectacle, one of the most impressive which man's work has created.

Her peculiarity lies in the fact that her outer skin, or envelope, is laid over a rigid framework of aluminium spars, connected and held together by a number of polygonal rings. The space within this framework is filled with the gas which lifts her; but she is not the simple balloon that she appears to be, for this internal space is divided into compartments, like the water-tight compartments of a ship, and each compartment forms a separate balloon, or ballonet, gas-tight and self-contained. The number of divisions varies. The first Zeppelin contained seventeen of them, covered with silk fabric, coated with indiarubber solution. Thus the puncturing of one ballonet will not greatly affect the airship. Over the framework is laid an outer skin, made of varying material—rubber cloth, or pegamoid; and this structure comprises the lifting portion of the ship. Beneath this envelope are the cars. In the Zeppelins these are two in number, one at the bow and one at the stern, connected by a covered gangway or deck. They contain the petrol motors that drive the propellers—of which the Zeppelin carried four,

one on either side of each car. Horizontal planes, or fins, on either side of the ship assist in maintaining the equilibrium, and also in the vertical steering of the vessel, while big vertical rudders steer the ship in the horizontal plane.

At the outbreak of the Great War, the type of airship best known to the world was the rigid type as exemplified by the Zeppelin. Count Zeppelin, already an old man, had spent the later years of his life and his entire personal fortune in the perfection of this giant vessel. It may be doubted whether the authorities in Germany would have assisted him to the extent that they did, if they had not anticipated that airships would be of immense value when "The Day" arrived, but Count Zeppelin probably had peaceful intentions in his mind as well as military. Be that as it may, Count Zeppelin had been at work many years upon his idea, and had exhausted all his funds, when, in 1908, the German Government offered to take over his invention at a certain price if he could maintain one of his airships in the air for 24 hours. Count Zeppelin was only too anxious to demonstrate the soundness of his theories, but at the crucial moment he was unable to comply with all the requirements of the test. What he did, however, was sufficient to call forth the admiration and enthusiasm of the whole nation, and a fund was established at once, patronized by no less a person than the Kaiser himself, to enable him to proceed with his work. If his ultimate dream was the conquest of the world by air warfare, we must write him down a failure, as his contemporaries did when the fleets

of his creation were rendered ineffectual by our own aeroplanes. But if he was simply pursuing the idea of air-mastery he was undoubtedly successful, for inventors of other countries have built much upon his efforts and results.

There were at this time three main types of airships in use; the rigid, as exemplified by the Zeppelin, which was also being followed by our own firm of Vickers at their works on Walney Island; the semi-rigid; and the non-rigid. The semi-rigid type had been occupying the minds of French constructors, the under side of the balloon only being fitted with a rigid framework. The firm of Lebaudy Frères commissioned M. Henri Julliot to make several airships for them on this principle, three of which were accepted by the French Government. The third type, the non-rigid, found favour on account of its greater portability, having no frame to occupy space when the gas bag was deflated, but for war service their great disadvantage was their vulnerability. Very soon after the commencement of hostilities with Germany, the British Admiralty awakened to the possibilities of airships as eyes for the Fleet, and the construction of small airships of the non-rigid type, such as those that came to be known as "Blimps", was put in hand. These craft were found to be capable of prolonged voyages in almost all kinds of weather.

One of the advantages claimed for the rigid type of airships, which is, generally speaking, the type that has been most followed in Britain and America as well as in Germany, is the permanency of the

shape, which does not vary even when there has been considerable leakage of gas. Thus they always present a stiff surface. The great aerial cruisers of to-day could scarcely have attained their huge dimensions along any other constructional lines. At present they are subject to very serious disabilities. Owing to the impossibility of deflating the outer envelope they are at the mercy of hurricanes when they are at rest, unless they are safe in the shed; and on descending—unless the wind is dead calm—the services of a regiment are required to manœuvre them.

Costly though they have been in lives and money, the disasters that have dogged the evolution of the airship have had their valuable side, in revealing constructional weaknesses, and in pointing the way to perfection. In time, no doubt, the most desirable form of mooring mast will emerge from the present confusion of freak designs, and when that happens the airship will have moved a most important step towards practical utility in a commercial sense.

Shortly before the Armistice, the British Admiralty had embarked upon the construction of a giant airship of the rigid type, which eventually became known as R 33. This vessel, with her sister R 34, had a cubic capacity of 2,000,000 cubic feet, and was capable of carrying a load of 30 tons. The hull was formed of lattice-work duralumin girders, and the gas was contained in nineteen ballonets. R 33 has made several very notable flights, including that from Pulham to London and back, making a circuitous

flight of 800 miles in 15 hours, but ten days later, on 16 April, 1925, she was torn from her mooring mast at Pulham by high winds, and carried across the North Sea, ultimately being brought up off the Dutch coast. Although she was considerably damaged, she was navigated home in safety the following day, thanks to the splendid handling of her by her crew. Later in the year this same vessel made a successful cruise lasting 19 hours, during which time she covered 700 miles.

To R 34 belongs the honour of being the first airship to cross the Atlantic. Although the weather conditions were very bad, the voyage was begun on July 2nd, 1919, the ship being under the command of Major Scott. Bad weather was experienced all the way, and when nearing her destination, banks of thick fog were encountered, but in spite of all obstacles the vessel made a successful landing, having taken 108 hours to complete the journey. R 34 was eventually wrecked, as was R 38, the largest airship then constructed.

In one very important respect in connection with airships, Britain achieved a great advantage over her enemies at the close of the war. In warfare, the enormous bag, filled with highly inflammable hydrogen gas, is a source of deadly peril, for once it becomes ignited the whole vessel and crew are doomed. The only other gas that could be used for the purpose was helium, but although the properties of helium were known many years ago, it was a very expensive gas to produce, and little of it was obtainable; in fact, one cubic foot of helium

was worth £300. But it was known that besides being non-inflammable, less of helium gets lost by diffusion through the envelope than is the case with hydrogen, and it was decided that steps must be taken to ascertain whether helium could not be produced in such quantities as to make its use for military airships practicable. Experiments and research on a large scale were initiated at once, and to Professor M'Lennan of Toronto University belongs the honour of proving that helium could be obtained in Canada so readily as to bring its cost down to a shilling a cubic foot. As things turned out, however, the Armistice was signed before any helium-filled gas bags were tried in actual service—though the gas has since been employed in American airships—but it is well to know that we have an alternative to hydrogen should that gas for any reason be unsuitable for particular work.

Much criticism has from time to time been levelled at the Government for persistence in its airship policy, which is now, fortunately, a "permanent" policy in the sense that it is not altogether at the mercy of political vagaries. It must be confessed that there is something to be said for the attitude of the critics, who resent the spending of the tax-payers' money on a type of craft that they believe, rightly or wrongly, to possess small offensive or defensive value. There is much less to be said for those who argue that the perfection of the heavier-than-air machines renders the airship obsolescent and unnecessary, and none at all, perhaps (if you happen to belong to another political persuasion) for the critics who urge that the

airship is a craft primarily of commercial utility, and that it is the business of those interested in commerce, rather than that of the state, to pursue experimental work that an impoverished nation can ill afford to pay for. Now, that airships are costly none can deny, nor that their history is in the main a sorry series of disasters.

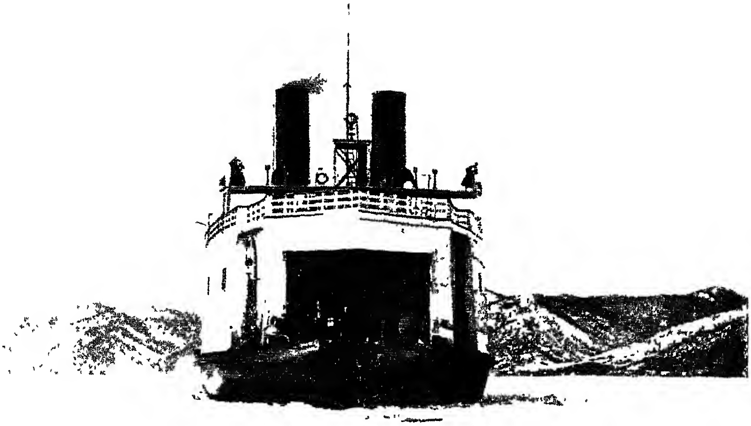
But two points seem to emerge clearly from the mass of criticism and counter criticism. Airships—not necessarily such as we know now, but of a more manageable disposition and greater carrying capacity—will doubtless take a place in course of time amongst the nations' traffic carriers. And no individual, or corporation other than the state, could ever be found to risk the millions that must needs be spent in experimental work before so great an enterprise can be launched in practical utility and public confidence. It is true that many high-powered aeroplanes can be built and even sacrificed for the cost of each airship like R 34. But though an aeroplane can fly the Atlantic, the airship can hold the air for a far longer time. Her radius of action, in spite of lower speed, is infinitely greater. Her carrying capacity proportionately to fuel consumption makes the aeroplane appear grossly extravagant and inefficient. In other words, as things are at present, it would be much cheaper to bring sixty people from New York to London in one airship than in ten separate aeroplanes.

But there were always those who scoffed at airships, and the development of the aeroplane has justified their faith in the heavier-than-air theory.

Photo Exclusive News Agency

THE BARMEN-ELBERFELD SUSPENSION RAILWAY

The electrically-driven cars on this railway are suspended from a single rail. The line is about 8 miles long, and connects two important manufacturing cities of Rhenish Prussia. It overhangs the beautiful River Wupper. *Chap. IX.*



ICE-BREAKING TRAIN-FERRY, LAKE BAIKAL

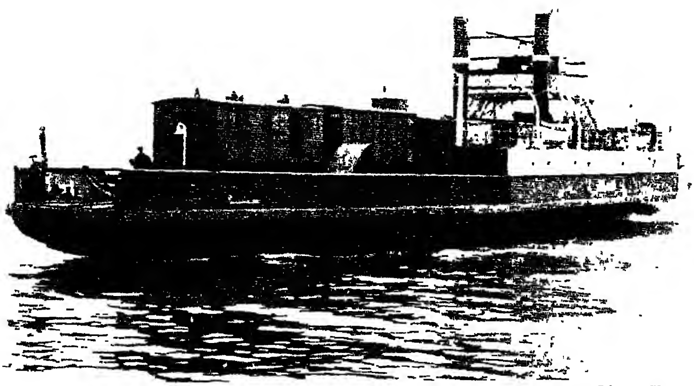


Photo Topical Press

TRAIN-FERRY AT FREDERICIA, DENMARK

Train-ferries exist in several parts of the world where waterways interfere with railways. The trains are run bodily on to the steamers *Chap. IX*

As soon as it had been definitely proved that the screw propeller could be used for aerial purposes, inventors began to turn their attention to the creation of a flying-machine on the lines of those used to-day; and in 1842 Henson produced a model monoplane, and drew up plans for a full-sized machine, which was never completed. His was a quaint, bat-shaped machine, with wide planes thrown out on either side of a car containing a steam engine coupled to two large air-fans, intended to act as screws. A triangular tail and a rudder were also included. The machine—a model of which may be seen now in South Kensington Museum, London—was a great advance in every way upon former attempts; but as its estimated weight was to be 3000 pounds, and its engine only developed 25 horse-power, it is exceedingly unlikely that it would have met with any success had it been finished.

In 1868 a machine very like the triplane of half a century later was exhibited at the Crystal Palace by Stingfellow. It was only a model, and the most notable feature about it was its tiny engine, which developed one-third horse-power, and was, for its size and weight, the most powerful model engine ever built, at that time. Multiplane machines were also built by Philips and Wenham about this time, and a certain amount of lifting power was obtained with them.

Then came Sir Hiram Maxim, with a mighty biplane of most imposing and romantic appearance, fitted with numerous auxiliary planes, and carrying two specially made steam engines, of 180 horse-power each. The weight of the machine, with its

crew of three, was no less than 8000 pounds. And during a trial run along a railed track, sufficient lifting power was developed to raise the whole huge machine a foot or two in the air. The run, however, ended in disaster, and in 1893 Sir Hiram Maxim abandoned his experiments.

Meanwhile some magnificent work was being carried out by three men who attacked the problem of flight in a less ambitious way. These men were Lilienthal, a German, Pilcher, an Englishman, and Chanute, an American, all of whom indulged in exhaustive experiments with man-carrying gliders. They employed various types of small monoplanes, with supporting areas curved in varying ways. Hanging from their machines, they would jump off from a hill or stage, and trust to their own balancing powers to keep aloft while their planes glided down, pulled earthwards by the force of gravity. All three made remarkable flights, which had a profound influence upon the construction of later aeroplanes. Both Lilienthal and Pilcher were killed by falls, their machines overturning in mid-air.

Then, in 1900, the famous Wright brothers, following in the footsteps of Chanute, made prolonged gliding flights in a biplane, and shortly afterwards, fitting it with propellers and a petrol motor, were actually flying at Kitty Hawk, North Carolina. Similar experiments were being carried out in France at this time; and as in 1893 a steam-driven model monoplane, built by the American, Professor Langley, had made a long and successful flight over the River Potomac, scientists were not backward in prophesying

that actual flight would soon be within man's power. Such forecasts met with considerable scorn; and it was not until 1906, when M. Santos-Dumont, of airship fame, made a small flight of 27 yards on a clumsy-looking biplane of his own invention, driven by a petrol motor, that public interest was really aroused. Then, scarcely had this little flight been made, when rumours were heard of the long flights made by the Wrights. Shortly afterwards the two brothers themselves appeared in Europe, and in 1908 the Farman biplane, the Blériot monoplane, and the Wright biplane were all flying well in France. In September of that year Wilbur Wright made a flight of 50 miles, remaining for an hour and a half in the air—and the conquest of the air was no longer a dream.

It is impossible and unnecessary to describe in detail the different machines that were turned out from the manufacturers' shops in ever-increasing numbers after the flight of the Wrights, and after the great Rheims flying meeting and the crossing of the Channel by Blériot in a monoplane. Suffice it to say that from the year 1908 onwards the growth and development of aviation and the perfection of this new means of transport were extraordinarily rapid. New biplanes and monoplanes were registered and turned out by the score, and hundreds of patents in connection with aviation were applied for, and obtained, in all countries. In the main, however, it may be said that all machines are constructed upon certain general principles, though every make has its variations in detail and finish.

One important point which the gliding work of

Chanute had gone far to establish was the necessity of having the planes "cambered"—that is to say, humped—in shape. This humping gives the plane, when forced edgeways through the air, a far greater supporting power than it would possess were it flat; for the concave under-surface catches and forces down a large quantity of air, producing a certain "lift", while the hump of the plane on the upper surface deflects a constant stream of air almost vertically upward, producing a partial sucking vacuum at the rear of the plane, as had been demonstrated by the experiments of Sir Hiram Maxim. This cambered, or arched, plane has been adopted universally, although different makes of machine employ varying degrees of camber.

All machines, too, are fitted with a tail of some description, often consisting of a fixed plane and two movable planes, acting as elevators; for by tilting these movable planes up or down upon their axes, the aeroplane is forced up or down through the air. All machines, too, use vertical rudders for ordinary steering purposes.

A vitally important point is the balancing of the aeroplane. The weight has to be very carefully disposed in order that the centre of gravity may not be too far forward or too far back, and so cause the machine to dive head or tail first. And to prevent the machine from tilting sideways two contrivances are employed. Many machines use *ailerons*, or balancers. These are two movable planes, one on either side of the pilot, and sometimes at the tips of the main planes. When the machine rolls, the

plane on the dropping side is twisted to present a greater surface to the air, and that on the lifting side to present a lesser surface. The resistance being thus increased on the dropping side, and lessened on the upper side, the aeroplane returns to an even keel, or, if turning, is prevented from banking over to a dangerous extent. Another method of stabilizing the aeroplane is that of warping—the main planes themselves being actually twisted in such a manner as to produce the effect of *ailerons*. It was this warping method that was used upon the Wright machines, with great success.

A landing chassis is a feature, too, of every aeroplane, consisting of wooden spars, shock absorbers, springs, skids and wheels fitted with rubber tyres, and brakes. There are many distinctive types of chassis, nearly every make of aeroplane having its own arrangement of skids or wheels.

Broadly speaking, aeroplanes of to-day may be classed as monoplanes and biplanes, but different builders introduce different features, just as no two makes of motor car are absolutely identical. Biplanes, for instance, may be propeller biplanes or tractor biplanes, as the propeller is behind to push the machine through the air, or in front to draw it. The hydroplane or sea-plane is usually a biplane, sometimes a triplane, fitted with floats to enable it to rest on the surface of the water. Aeroplanes of this type have been adopted as an essential unit of the navy, and special mother-ships have been constructed to act as bases in mid-ocean. The floats of sea-planes are of layers of thin wood, arranged to form water-tight

compartments, and they must be so placed as to counteract the dipping tendency given to the hydroplane by the position of the propeller, which must be set high above them to avoid beating the waves.

In writing of aeroplanes of to-day, it is necessary to turn to the pages of war history, since it is on account of its service in war that the aeroplane has reached its present position in the commercial world, and we have no means of knowing how it would have developed if there had been no war to force it into prominence and usefulness. We know that in 1914 flying was recognized as an established means of progression. Both the army and the navy had organized air forces, and flying contests both of an international and a domestic nature were of frequent occurrence. But the number of persons really interested in the new means of transport was negligible. The army possessed sixty aeroplanes, implying a *personnel* of a few hundreds at the most. Of the general public, only a specialized few—a mere fraction of those interested in horse-racing—even looked at the flying news, or knew the names of the competitors in the trials. An awakening of the common mind to the possibilities of flight would have taken many years at the rate of progress prevailing at that time. With the outbreak of war, the whole position changed as if by magic. Thousands of young men immediately started to qualify as pilots in one service or the other, and the manufacturers of aeroplanes found themselves confronted with a demand for machines for which they were ill prepared. But the machines were for particular purposes, and therefore it may be

considered that from this date the experimental stage of aeroplane construction came definitely to an end. The first, and to begin with the only, work of the aerial forces in war was reconnaissance. For this service, whether for military or naval use, the rapidly flying scout was required, assisted or reinforced by larger machines capable of carrying two or three men, whose task it was to make detailed observations. Later in the war, wireless telephones became a part of every aeroplane's equipment, and the hazardous task of swooping over the enemy for the purpose of taking photographs of his position became a daily custom. Meantime, actual warfare in the air became more and more competitive, that is to say, allowing for the unparalleled daring and cunning of the pilots, it was a struggle for mechanical supremacy. Beginning with the little single-seater scout, the Sopwith Camel was able to destroy the notorious Baron von Richthofen because it was handier and speedier than the German's machine. The Bristol-Fighter, driven by a Rolls-Royce engine of 220 horse-power, was capable of great speed and could reach a height of 20,000 feet in less than half an hour. Everyone remembers the great Handley-Pages, whose bomb-dropping expeditions wrought such havoc in the latter days of the war; while the Germans were using Giant Gothas in which a crew of nine and a load of two tons of bombs were easily carried by a machine driven by five engines of 260 horse-power each.

These details are mentioned for the purpose of emphasizing what the war did for the development of air transport. Firstly, it trained men to become

fearless pilots; secondly, it taught manufacturers to build two distinct classes of aeroplanes, the little machine for speed, and the large one for weight carrying; and thirdly, it taught the world that the supremacy of the air had been attained. No one could doubt any longer that, given a sound machine and reasonable weather conditions, safety in flight was simply a question of a good pilot. Public confidence thus was won in the space of four years, whereas in normal circumstances the acceptance of flying as a daily means of transport would have involved many years of demonstration work by a few enthusiasts. So rapid, however, has been the growth in popularity of flying, that many firms of aeroplane constructors are now turning out small machines for private or family use, in large numbers. These machines are easily landed and housed, and are coming more and more into favour for holiday purposes. The winner of the Air Derby of 1926 was a "Moth" driven by a "Cirrus" engine of 27–60 h.p.

Just what the modern motor can do—ignition-timing, valve-timing, lubrication, and other intricate details functioning perfectly hour after hour at terrific speed—can perhaps be judged from the world record set up by a French military airman in the summer of 1926. Captain Arrachart flew from Paris to Basra, a distance of 2737 miles, without a stop, in 26 hours 35 minutes, that is to say, at an average speed of well over 100 miles an hour. And within a few weeks that record had been beaten by another French non-stop flight, that of Captain Girier and Lieutenant

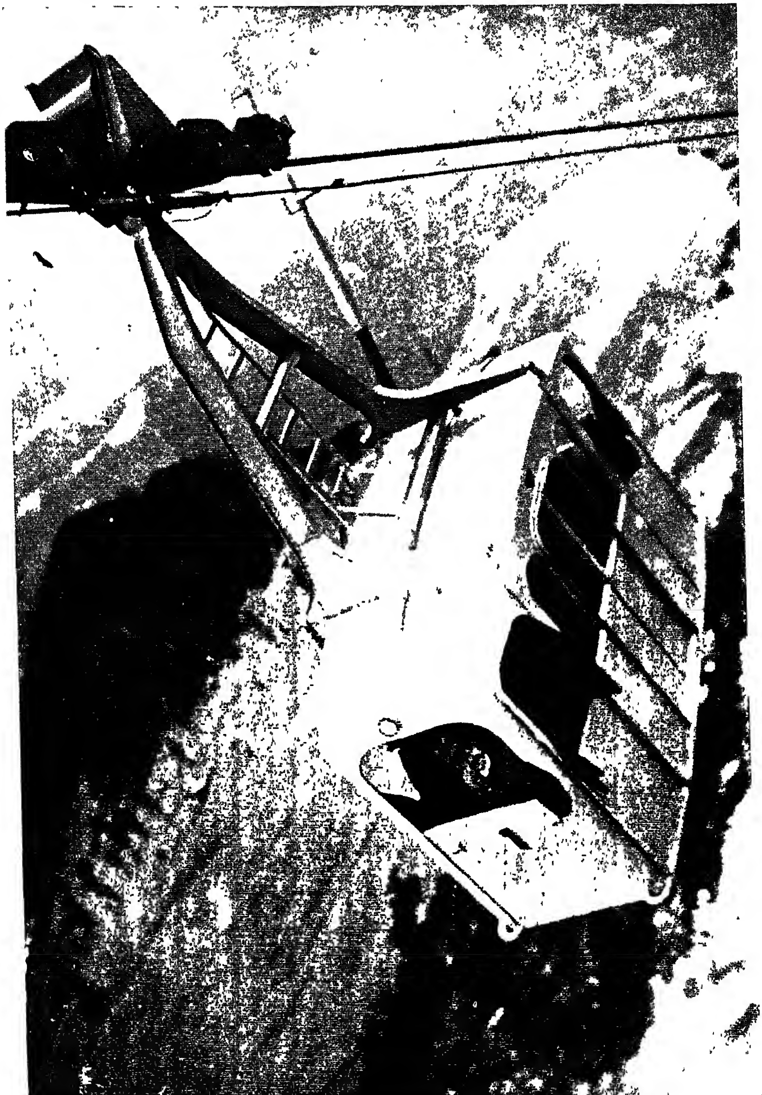


Photo. James's Press Agency

AN AERIAL RAILWAY

The car making its ascent on the aerial railway to the summit of the Zugspitze in the Bavarian Alps

Chap IX.

Dordillet, from Paris to Omsk in Siberia, 2937 miles in 29 hours.

But, when all is said and done, it is the slow but sure growth of the regular passenger and mail services, in the face, as usual, of opposition and prejudice, that is the most hopeful sign of the future of civil aviation. It is literally true to say that the deserts and the stony places of the earth have lost their terrors for the traveller, but it is the terminal stations of the great air-lines we must watch if we are to gauge the new transport at its true value. Watch the travellers arriving and embarking at Croydon Aerodrome—politicians and distinguished public persons, substantial business men, sportsmen, tourists, honeymoon couples; see the baggage and parcels being handled, the activity of the customs officers, the general air of business attending the arrival or departure of the Continental air expresses, and we get a better idea of the commercial future of aviation.

It is only natural that, once the experimental stage was passed and public confidence established, the passenger accommodation on the air liners should have been improved to the present pitch of luxury. A passenger can scarcely want anything more, unless it be a little less noise. You may be sick, but you will not be bored; and if you are one of the twenty passengers bound for Paris on board the Imperial Airways liner *Argosy*, let us say, your only possible ground of complaint will be in the shortness of your journey. It will occupy considerably under two hours.

CHAPTER XI

His Majesty's Mails

THE other day my friend the postman brought me a very queer packet. Whence it came was no mystery; of course, the stamp and the postmark gave the show away directly. I may as well tell you, without more ado, that it came from Fusan, in Korea. As you may have forgotten what you must have learnt about that strange corner of the globe during the Russo-Japanese war—in which it played an important part—forgive my impudence in reminding you that Korea, Corea, or Chōs-en, whichever way you prefer it, is the great peninsula that stretches out between the Sea of Japan and the Yellow Sea, and is separated from Japan itself by the Strait of Korea. My packet was, I have said, queer. My friend the rural postman thought so. As he put it, "It looks as though it has come from somewhere". And as he handed it in he could not have been more important had he brought my packet all the way from Fusan by his own efforts unaided. And truly it was a thing to be marked among all the postal packets one may expect to receive year in and year out. It was enclosed in the neatest of envelopes, not of paper, but of rush matting daintily secured with very fine cord.

It was excessively sealed and stamped with many ferocious dragons. The label was so neat that it might have been made out in a London office; but this effec was rather spoilt by the repetition of the address up and down each side and along the top in Chinese characters, which made it look rather as though a frivolous Chinese boy had been playing naughts and crosses with it on its way.

This was all very interesting; but my packet's most salient feature was its smell, which suggested a Far Eastern delicacy in the way of fish. On investigation the smell was found to proceed, not from the contents of the packet, but from an oiled-silk wrapper that lay beneath the outer covering, and which, like the seals, can only be described as excessive. Beneath this again there were several underblankets of paper; these removed, there lay disclosed the prize: The Illustrated Guide to the Chosen (Korean) Railway—presented with the compliments of the Railway Bureau of the Government-General of Chosen—printed in English, admirably illustrated, beautifully got up, and, in short, an excellent example of what a railway guide ought to be, but seldom is. It had been brought to me at a cost of a few coppers—the postage stamp was paid for in yen—over some 7000 miles of railway—the great Trans-Siberian route we spoke about in a previous chapter. It had passed through many famous towns—Mukden, Harbin, prosperous Irkutsk with its magnificent cathedrals and its far-flung trade, historic Moscow, and young Berlin. There's a wonder of transport for you! or, rather, a succession of wonders—the conglomeration of things

familiar and unfamiliar: the matting that wrapped my packet, the fishy smell, the English writing and the Chinese cyphers; the mighty all-pervading influence that printed a Korean guidebook in English, the railway it extolled, the strange cone-hatted, semi-civilized men and women of its country, so nea to us in the Post Office Guide, and yet so far away in all but the time of a railway journey. Shades of Trevithick and Stephenson! your spirit moves in this, to weld the nations of the earth in a closer bond of union than is dreamed of by ambassadors.

I have told you this little story of my packet from Korea because it illustrates the immensity of the postal system. The post is transport, and the essence of transport, as much as transport is the essence of commerce. And our story of the wonders of transport would be obviously incomplete if it failed to tell of those wonders which we associate with the postman's knock.

In a previous chapter I have mentioned the Incas of Peru, who, at a period so long ago that we hardly know when it was, had traversed their country with wonderful roads, and on these roads had stationed swift messengers who could cover a distance of three hundred miles in a night. These men were probably the world's first postmen. We have derived the word "post" from the Latin *positum*, fixed, which at first seems rather contradictory, for we have a way of saying "post-haste" when we mean as quickly as possible. The posts, however, originally were the stations on the road where the runners waited, or where relays of horses were kept. In ancient times

of course, only messages and dispatches of great importance were sent by the post, private letters, which I suppose were very rare, being entrusted to some traveller who might be going in the right direction. It is small wonder that letters often failed to reach their destination, for in the old days it was no unusual thing for a traveller to be robbed and murdered. The ancient Greeks and Romans had admirable systems of couriers; in fact the establishment of some definite line of communication has been an essential part of every civilization. Uncivilized peoples have other modes of sending messages of importance. Many savage tribes telegraph to one another by means of their war drums. Tom-tom, tom, tom-tom, tom, tom-t-tom go the drums at one village, and the message is taken up by the next village and sent on to the next with incredible swiftness. Beacon fires have been used as long as fire has been known, but they have very great disadvantages and are not reliable means of communication.

Marco Polo gives us the following details of communication in the country of the Grand Khan, which is what we now call the Chinese Empire, in the thirteenth century:

"From the city of Kanbalu there are many roads leading to the different provinces, and upon each of these, that is to say, upon every great high road, at the distance of twenty-five or thirty miles, accordingly as the towns happen to be situated, there are stations, with houses of accommodation for travellers, called yamb or post houses. These are large and handsome buildings, having several well-furnished

apartments, hung with silk, and provided with everything suitable to persons of rank. Even kings may be lodged at these stations in a becoming manner, as every article required may be obtained from the towns and strong places in the vicinity; and for some of them the court makes regular provision. At each station four hundred good horses are kept in constant readiness, in order that all messengers going and coming upon the business of the grand khan, and all ambassadors, may have relays, and, leaving their jaded horses, be supplied with fresh ones. Even in mountainous districts, remote from the great roads, where there are no villages, and the towns are far distant from each other, his majesty has equally caused buildings of the same kind to be erected, furnished with everything necessary, and provided with the usual establishment of horses. . . . In his dominions no fewer than two hundred thousand horses are thus employed in the department of the post, and ten thousand buildings, with suitable furniture, are kept up. It is indeed so wonderful a system, and so effective in its operation, as it is scarcely possible to describe. . . .

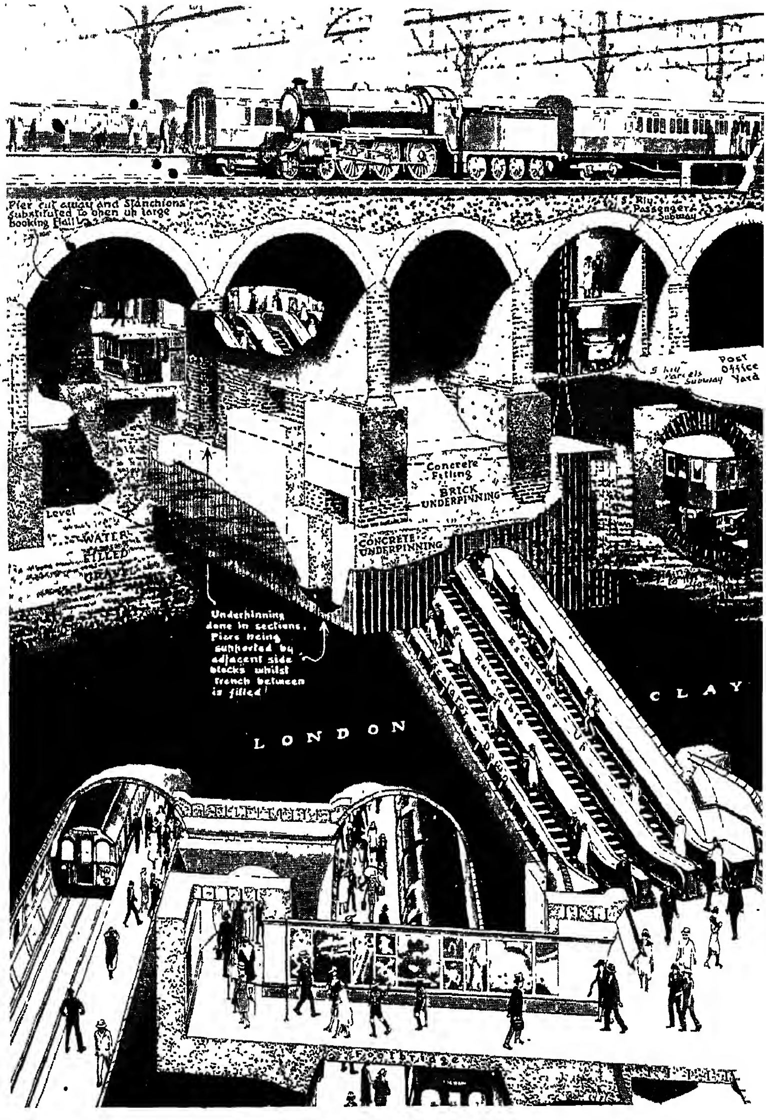
"In the intermediate space between the post-houses, there are small villages settled at a distance of every three miles, which may contain, one with another, about forty cottages. In these are stationed the foot messengers, likewise employed in the service of his majesty. They wear girdles round their waists, to which several small bells are attached, in order that their coming may be perceived at a distance; and as they run only three miles, that is, from one of

these foot stations to another next adjoining, the noise serves to give notice of their approach, and preparation is accordingly made by a fresh courier to proceed with the packet instantly upon the arrival of the former. Thus it is so expeditiously conveyed from station to station, that in the course of two days and two nights his majesty receives distant intelligence that in the ordinary mode could not be obtained in less than ten days; and it often happens that in the fruit season, what is gathered in the morning at Kanbalu is conveyed to the grand khan, at Shan-du, by the evening of the following day; although the distance is generally considered as ten days' journey. At each of these three-mile stations there is a clerk, whose business it is to note the day and hour at which the one courier arrives and the other departs; which is likewise done at all the post-houses. Besides this, officers are directed to pay monthly visits to every station in order to examine into the management of them, and to punish those couriers who have neglected to use proper diligence. . . .

"When it is necessary that the messengers should proceed with extraordinary dispatch, as in the cases of giving information of disturbance in any part of the country, the rebellion of a chief, or other important matter, they ride two hundred, or sometimes two hundred and fifty miles in the course of a day. On such occasions they carry with them the tablet of the gerfalcon as a signal of the urgency of their business and the necessity for dispatch. And when there are two messengers, they take their departure together from the same place, mounted upon good fleet horses;

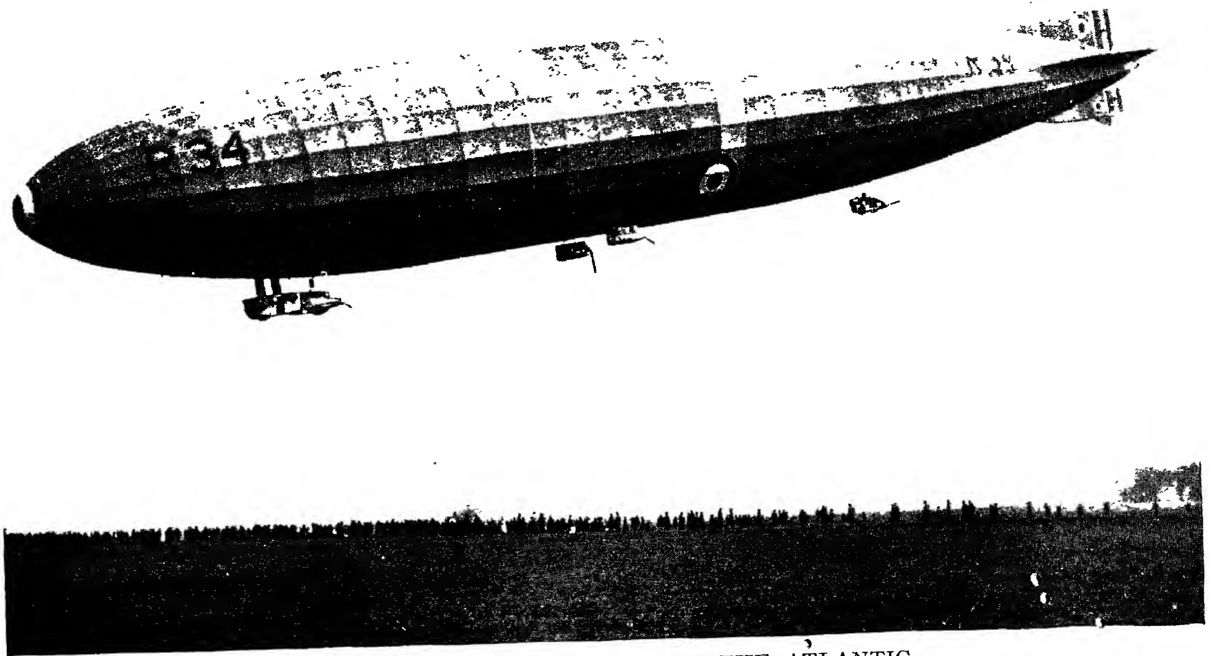
and they gird their bodies tight, bind a cloth round their heads, and push their horses to the greatest speed. They continue thus till they come to the next post-house, at twenty-five miles distant, where they find other horses, fresh and in a state for work; they spring upon them without taking any repose, and changing in the same manner at every stage, until the day closes, they perform a journey of two hundred and fifty miles. In cases of great emergency they continue their course during the night, and if there should be no moon, they are accompanied to the next station by persons on foot, who run before them with lights; when of course they do not make the same expedition as in the day-time, the light-bearers not being able to exceed a certain pace. Messengers qualified to undergo this extraordinary fatigue are held in high estimation."

The first letter post was established in the Hanse towns in the thirteenth century, and was greatly improved and developed by the Emperor Maximilian. In our own country a postal system was always instituted in times of war, for the carrying of dispatches to and from the front. Henry VIII was the first monarch to establish, only for his own use, a permanent post, and by his command Sir Briar Tuke set up posts "in all places most convenient". In the time of Elizabeth there were four postal routes, to Scotland via Berwick, to Beaumaris for Ireland, to Dover for the Continent, and to the Royal Dockyard at Plymouth, but these posts were simply for the use of the Court, and only postmasters were allowed to keep horses for posting or to collect and deliver letters.



BURROWING BENEATH LONDON

A section showing the big triple escalator descending to the new underground station at Waterloo. *Chap. IX.*



THE FIRST AIR-SHIP TO CROSS THE ATLANTIC

The R34, which crossed from Scotland to New York in 108 hours, and made the return journey in 75 hours. Inside the hull is the keel, forming a tunnel through the gas-chambers. It gives access from one gondola to another, and contains the combined dining- and recreation-room of the crew.

Chap. X.

In those days, of course, very few people could write, and those who could were of very superior education. The times were troublous, the air was thick with plots and counter plots, which were organized by educated people. People who could send or receive letters were considered quite capable of conspiring against their queen and country, and were suspected accordingly. Indeed, so nervous were those in authority that to carry a letter was made a criminal offence, and anyone detected in the act was thrown into prison. One cannot help wondering what would have been the result if, instead of suppressing communication, Elizabeth had encouraged it. Certain it is that suspicion encourages deceit, and I think I know a good many people who would plot and conspire if they were forbidden to do so, simply for the excitement, or because it was the fashion.

We owe a great deal to a man of whom few of us have ever heard. In the seventeenth century, when it took a month to send a letter to Scotland, when roads were for the most part myths, when half the postmasters in the country were in prison for debt, since no one had thought of paying the poor fellows for years and years, Thomas Witherings organized a system by which private letters could be sent at private cost. He also persuaded the postmen to "hustle", to such good purpose that they managed to perform the journey to Edinburgh in six days. Mail coaches first appeared towards the end of the eighteenth century, and were immediately successful, in spite of the vigorous opposition of the Post Office; to be followed in 1830 by the first mail train. All

this time the charges for sending letters were terribly high. One sheet weighing a quarter of an ounce could be sent to Brighton for eightpence, to Aberdeen for one and twopence, and so on, while a double sheet cost double that amount. Needless to say, whenever possible, letters were smuggled from one place to another in various ways. When Sir Rowland Hill introduced his Penny Post scheme, the idea was received with indignation and ridicule, was voted absurd and impossible; but Sir Rowland had his way and the thing was given a trial. Of course its success was immediate. A community that had somehow managed to send letters at a cost of several shillings did not hesitate to make use of a service that only cost a penny.

The British Post Office is the largest and most complete institution in the world. It makes regular use of every known means of transport, and we may be sure that in times of emergency it improvises any means it can to fit the occasion. A great deal of the work of sorting the letters is done on the postal trains that are racing across the country in all directions at dead of night. While you are fast asleep, hundreds of sorters are working against time in the travelling post offices, in order that your letters may await you when you come down to breakfast. These travelling post offices are marvels of skilful contrivance. Apart from the mechanism for picking up and setting down the mail bags while the train is travelling at full speed—these two operations are performed simultaneously—the vehicles are artfully arranged sorting offices in which a vast amount of work is done under

conditions as comfortable as it is possible to make them They are well lighted, well aired, and well warmed, and all projecting parts are carefully padded to avoid possible injury to the sorters when the train sways or lurches.

There are many places in the British Isles where a postman does not call every day. Some of the lochside villages of Scotland are only visited by mail steamers three times a week in winter. The Shetland Islands receive letters four or five times a week, the Scilly Islands only twice a week in winter and three times a week in summer. St. Kilda is sometimes isolated by rough seas for weeks at a time, and no ship can call to deliver anything. Then the letters are put in a cask, to which a flag is attached, and the islanders wait for a favourable opportunity to send a boat out to pick it up. They post their letters in the same way, sealing them in a bottle or cask, which they consign to the sea in the hope that some vessel will pick it up and ultimately post the letters. But even the loneliness of St. Kilda is nothing to that of the men on remote lightships and lighthouses. Some of these only receive supplies and letters once a month. Tristan da Cunha is perhaps the loneliest spot in the world. Its little mail bag sometimes lies at the General Post Office for as long as two years before a ship leaves England that intends to call.

In other parts of the world we find the postman equipped to face climatic conditions. In some parts of South Africa he runs *au naturel*, except for an elegant girdle of feathers, carrying the letters in a forked stick. In the East he is generally provided

with an umbrella. If he has to wade through a river in the course of his journey the mail bag goes on his head, well out of the reach of the water. Or he may be in the region of ice and snow, and go upon skis or skates. He has any number of willing four-legged helpers, too. When we send a letter to Klondyke, for instance, we know that it will probably finish its journey on a sledge drawn by dogs; or in Lapland, one drawn by a reindeer. In the deserts of Africa a camel will carry it, a llama in the wild and rocky districts of South America, while we secure the services of the elephant in India for our penny.

Our letters perform no mean journey in the post office itself, that is to say, of course, the General Post Office. Nearly 46,000 tons of letters come to this office every year, but so wonderful is the organization that at any minute of the day any bag of letters could be found immediately. Baskets full of letters are received on revolving bands and taken off to the sorters. The letters are then made up into packets and dispatched to another department. Here the bags are made up, and as each bag is ready it travels along a revolving band, at the end of which a man and a mail cart are waiting to receive it. The latest development in mail transport is the scheme for building miniature electric tube railways to connect the General Post Office with the great termini.

To every individual in the kingdom, whatever his or her station, the efficiency of the postal system is a matter of the first importance, and the public had a right to expect that, when the motor car appeared and offered improved means of inland transport, the

Post Office would adopt the mechanically propelled vehicle in the interests of the public service. The authorities of St. Martin's-le-Grand may have been a trifle slow in moving in this direction, but perhaps there was wisdom in allowing the experimental stage to pass without imperilling His Majesty's mails and burdening the taxpayer with big charges for useless cars. Now the motor mail service is firmly established, and there is no possibility of any looking back; indeed, were any suggestion made of abandoning the inland motor mail, it would probably be regarded as a retrograde step, as much as would a proposal to revert to the sailing vessel for the purposes of the overseas mail.

Although it took the Post Office authorities a long time to make up their minds to the use of motor vehicles, it cannot be brought against them that they have been slow to adopt the aerial mail. The aeroplane was pressed into the service as soon as civilian flying was able to detach itself after the war, and the state subsidy of the companies maintaining regular Continental communication gave a natural impetus to the development of the speediest method of conveying mails across the narrow seas. There are now direct daily air-mail services between London and Paris, Cologne, Brussels, and Amsterdam. From these places the mails are transhipped to the machines working the inter-continental air posts, and there are very few large cities in Europe to which you cannot send a letter by air with a very considerable saving in the time it will take to reach its destination. By payment of the very reasonable air-mail fees, you can

save a day on a letter to Paris or Berlin, two days to Italy, three to Jugo-Slavia, sixteen to Teheran, and so on. It is true that the services are sometimes cancelled owing to bad weather, but for the most part they run as closely to schedule as the Flying Scotsman or the Wild Irishman.

In another chapter we touched upon the opening up of air routes all over the world; and in days to come—not very many days, in all probability—we shall think with gratitude of the flying pioneers who established these routes, and so made the linking up of world air services possible. There is the business aspect, involving the axiom of economics that where-ever communications are improved, wealth will follow: and there is, for most people, the more urgent question of how and where it may earn for them a livelihood. The white peoples of the earth are increasing at the rate of some five millions a year, while the land that is cultivated to produce food enough for them is not increasing nearly fast enough in proportion. Economists warn us that unless the world's productivity is largely expanded, there will come a day, and that not very far hence, when there will literally be not enough food to go round. Now this means, of course, that the peoples of Europe and America, and the younger nations over the seas, must travel farther afield to gather the food for the teeming world's larder. It is not hard to understand why, as things are now, only the bravest or the wisest or the most desperate men and women seek their fortunes in distant places.

Every year more and more of the children of Great

Britain leave their homes to wander far away in search of fortune, or in the service of their country; every year more and more little pale-faced children are sent home from unhealthy, tropical surroundings, in charge of ayahs or obliging friends. To the mothers and fathers of these scattered families, what will be the joy and relief of having regular news of their loved ones, not three or four weeks old, but letters still almost warm from the hand of the writer!

The extension of air-mail services will bring about the annihilation of distance even more quickly than the air passenger service, though the two will be worked together. Few persons can afford the time and money for travel, compared with the multitudes who can avail themselves of the post. Think of writing a letter to Australia and receiving an answer in three weeks' time! Think of the remote and inaccessible places of the earth, the islands in the pathless sea, the cities in the waterless desert, all drawn together by the magic of the airman. It is probable that the long-distance air-mails will be carried by airships. An official forecast of the probable time occupied in the journeys gave the following:

England to Egypt, 2½ days,
,, ,, Karachi, 5 days,
,, ,, Johannesburg, 7 days,
,, ,, Perth, Western Australia, 10½ days.

A little while ago a scheme was put forward that sounded as fantastic as anything in Jules Verne, and yet was not laughed at, or pooh-poohed, but seriously considered by hard-headed men. Its aim was to

assist in stabilizing an international trans-Atlantic air service by the provision of floating islands at intervals along the route. It is proposed to establish eight of these islands, enormous pontoon-borne platforms, each of a hundred acres, on which, as well as easy landing-grounds, there would be lavish hotels, petrol tanks, well equipped machine-shops, gigantic beacons—everything, in short, that the aerial mariner and his passengers could reasonably desire. The strange thing is that there is nothing fanciful or impracticable about this scheme, except its cost; and we may live cheerfully to bear that, and to count it amongst our blessings.

THE ERA OF THE HUGE AEROPLANE

The Vickers-Rolls-Royce "Vanguard" which carries twenty-five passengers at a speed of 115 miles per hour. *Chap. X.*